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Annual Report

of the

Department of Agriculture

1933

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PART I.—Agriculture in Nyasaland.

General.

Weather Conditions—The season 1932-33 opened normally in most districts and early growth was good everywhere. The rains of January were accompanied by low temperatures and lack of sunshine, but in the Shire highlands conditions rapidly improved by early February and good weather was reflected in good crop yields at a later date. Food crops were abundant generally and the tobacco crop was above normal in the central areas of Nyasaland. The worst areas for maize were the Bwanje-Ntakataka lake littoral and west of Zomba mountain, but these obtained relief from adjacent districts and the fish trade near the lake and the Shire is generally an insurace against famine.

The tea belts of Mlanje and Cholo suffered from shortage of rain during the year, the total in the latter area being 15 inches below normal. The drought was apparent early in the year but a good recovery was made by the tea towards the latter part of the year and out-turns were but little below normal.

On the Lower River the rainfall during January and February was extremely localised and many areas suffered from short periods of drought. During March there was a universal shortage, and, although the light-land grain crops were not much affected, planting in *dimba* areas was delayed, beans, sweet potatoes and late maize being planted some weeks later than usual. Weather conditions throughout the remainder of the season were fair although the total rainfall was some 5 inches below normal and the absence of mid-season rains seriously affected the cotton yields. The rise of the Shire river was not sufficient to flood any except the lowest lying dimbas and by March the water level was dropping steadily. The Ndindi marsh dried out very rapidly and the land was cracking by the middle of the year.

In the Northern Province conditions during the growing season were not so good as those of similar areas of the Southern Province, and the abnormal rainfall and low temperatures of February were reponsible for considerable reductions in the tobacco and rice crops when compared with normal years. Conditions during ripening and curing periods, however, were quite fair and were particularly propitious for air- and sun-curing of dark tobacco. The crops which benefited from the prevailing weather, particularly in northern and central areas, were the groundnuts and sweet potatoes which were encouraged in view of the locust menace.

Production and Export.—The following table shows European production and acreages of the principal crops over the last three years.

	1931		1932		1933	
	Acres	Yields	Acres	Yields	Acres	Yields
Tea	11,414	2,193,296 lb. ...	12,596	2,699,984 lb. ...	13,830	3,049,760 lb.
Coffee	1,542	1,175 cwt. ...	1,449	767 cwt. ...	1,210	1,128 cwt.
Tobacco	13,482	4,168,528 lb. ...	14,314	6,252,288 lb. ...	7,862	3,488,016 lb.
Sisal	9,304	153 tons ..	9,785	25 tons ...	—	—
Cotton	225	159 cwt. ...	265	341 cwt. ...	246	682 cwt.
Rubber	1,500	— ...	1,500	— ...	1,500	—

The production (reckoned by amounts sold) and numbers of growers of cotton and tobacco, the only two native crops of consequence at the moment, were as follows in 1931, 1932 and 1933.

	1931		1932		1933	
	No. of growers	Production	No. of growers	Production	No. of growers	Production
Cotton (seed cotton) ...	—	2,477 tons	... 13,260	2,698 tons	... 26,242	3,080 tons
Tobacco	51,903	3,519 tons	... 53,044	5,904 tons	... 56,026	4,077 tons

The following table, the figures of which have been taken from the *Annual Report on the External Trade of the Protectorate* for 1933, gives the amounts and values of agricultural produce and raw materials exported during the last three years.

	1931		1932		1933	
	Quantity	Value £	Quantity	Value £	Quantity	Value £
Capsicums and chillies ...	1,098 lb.	14 ...	239 lb.	3 ...	16,633 lb.	208
Coffee	834 cwt.	1,988 ...	789 cwt.	1,840 ...	357 cwt.	833
Maize and maize flour ...	311,452 lb.	558 ...	5,400 lb.	9 ...	39,454 lb.	44
Potatoes	34,150 lb.	182 ...	97,136 lb.	511 ...	125,397 lb.	671
Tobacco	10,690,581 lb.	400,897 ...	15,082,035 lb.	565,576 ...	10,394,498 lb.	389,794
Tea	1,963,452 lb.	49,129 ...	2,573,871 lb.	42,898 ...	3,276,477 lb.	59,656
Beeswax	195 cwt.	1,092 ...	170 cwt.	953 ...	240 cwt.	1,348
Cotton (lint)	1,011 tons	37,729 ...	935 tons	34,916 ...	1,082 tons	50,014
Cotton seed	628 tons	1,257 ...	1,138 tons	2,276 ...	616 tons	1,232
Fibre (all kinds)	242 tons	2,661 ...	940 lb.	3 ...	20 tons	162
Groundnuts	1,100 lb.	6 ...	—	— ...	253 tons	1,519
Rubber	—	— ...	—	— ...	71,955 lb.	300
Strophanthus	10,581 lb.	1,587 ...	7,601 lb.	1,140 ...	17,521 lb.	2,628
Rice	2,176 lb.	10 ...	6,201 lb.	28 ...	2,438 lb.	11
Sesame seed	—	—	—	— ...	7,184 lb.	30

Increases are recorded in the case of tea, cotton, capsicums and chillies, maize and maize flour, potatoes, beeswax and strophanthus. Groundnuts and sesame seed appear for the first time, at least for a number of years, and it is hoped that the 1933 amounts are the beginnings of a large export. Small quantities of fibre and rubber were exported, but unfortunately they do not point to a renewal of activity in these industries. Cotton seed exports declined as a direct result of low home prices, while tobacco exports declined as a result of lack of interest in one direction and a voluntary restriction in another.

With the exception of tea, market prices of Nyasaland products remained at a low ebb, but, despite the general discouraging conditions, efforts have been made to find outlets for produce and to introduce new items to overseas markets. An experimental consignment of mixed produce was sent to England for report and sale through the Crown Agents for the Colonies. It consisted of edible beans of various kinds, yellow Honduras maize, white Kaffir corn, pearl millet, sun-flower seed, groundnuts and soya beans. As far as quality is concerned, the reception of the various items was encouraging on the whole, but the fact remains that market prices leave little or no profit to the exporter. If market conditions would improve to give a profit to the exporter and a reasonable price to the grower, Nyasaland could produce and export large quantities of various oil-seeds, grains and pulses, and increased quantities of cotton and tobacco. The experimental growing and testing of new crops was continued, and, with the appearance of a buyer, the department was able to issue seed towards the end of the year and encourage the production of groundnuts and simsim in central Nyasaland.

Locusts.—The development and spread of the red-winged locust (*Nomadacris septemfasciata*, Serv.) continued throughout the year. The hairy-chested locust (*Locusta migratorioides*, R. and F.) was also present in small numbers but swarms of this species were negligible in comparison with the former, except in the North Nyasa district. The red-winged locust invaded the Protectorate at two distinct points: through Fort Manning from north-eastern Rhodesia, and into the Chikwawa and Lower Shire districts from Portuguese territory to the west. The latter invasion confined itself to the districts mentioned whereas the former affected nearly all districts south of latitude 12° 30′S. Egg-laying took place almost immediately and continued until late in January; hatching occurred up to the middle of February. New flying swarms appeared during March and April, and during the dry season these swarms congregated in forest country on the hill slopes.

In the early part of the year the littoral of the North Nyasa district was severely invested with hopper swarms of *Locusta migratorioides* alone. Flying swarms developed in January but their movement during the dry season was obscure; probably they departed into north-eastern Rhodesia. Other flying swarms of this species that developed in the Upper Shire and South Nyasa districts moved towards the north-east and north-west, presumably into Portuguese East Africa.

Renewed activity of the red-winged locusts began in September. Egg-laying took place at an unexpectedly early date (November in the Lower Shire district) and continued for some two months or more. Districts, such as Mlanje and Chiradzulu, which had not previously been infected were visited by egg-laying swarms. Hoppers developed in considerable numbers in practically every district in the country, but for some obscure reason North Nyasa remained comparatively free.

On the whole, surprisingly little damage was done to native food crops by flying swarms or hoppers, although certain areas, e.g. Chiromo, Utale, suffered a certain amount of loss. Where European assistance was available, destruction of hopper swarms on the basis of garden protection was vigorously pursued and a considerable measure of success was achieved in the North Nyasa, South Nyasa and Upper Shire districts in particular.

Board of Agriculture.—In last year's report it was intimated that the Board of Agriculture which was set up in late 1932 had appointed an Alternative Crops Committee and a Native Agriculture Committee which had begun their work in early 1933.

The former committee considered the following subjects: export of maize, rice, edible beans, groundnuts, soya beans and other oil-seeds, essential oils, coffee growing, and citrus for export. The other committee began its work by considering the destruction of forests and natural vegetation on steep slopes, the lack of measures in native systems of agriculture for retaining soil and maintaining fertility, the uneconomic use of land in the growing of certain crops, e.g. finger millet, overcrowding due to immigration, and the control of bush burning, and at a meeting in August it was able to report progress along the lines of its recommendations and to discuss other matters such as irrigation, the work of the new experimental station near Lilongwe in its relation to the native tobacco industry, and matters of afforestation and fire protection.

The two committees submitted recommendations to the full board, and the latter forwarded its views on the various recommendations and on other matters which were placed before it to Government for consideration and for approval of the action suggested in each case. The board thus had under review all the subjects mentioned above and also the matter of rules under the Maize Ordinance of 1926, the locust position, the question of trade representation of Nyasaland in the United Kingdom, the cotton industry, native coffee growing, temporary development railway rates, the dark tobacco industry, a dairy industry and the growing of olives. Many matters of great importance to Nyasaland were discussed and ventilated, and, when necessary, full attention was given to the economic aspect of growing and export. Perhaps the most important items of the work of the board were those concerned with the possibility of growing citrus for export, the expansion of the cotton industry and the development railway rates. The discussion of citrus led to the appointment of an expert in the person of Professor Clark Powell of Pretoria University who visited the country and reported on citrus prospects

(Bulletin No. 8) while the discussion of the cotton industry led to the appointment of a small committee which was charged with the duty of recommending legislation for the control of the industry in all its aspects. Full accounts of the deliberations of the board and its committee have been published for local circulation in Bulletins Nos. 6 and 10.

Colonial Development Fund.—The end of 1933 saw in an advanced condition the work undertaken under the auspices of the fund. The new headquarters buildings and laboratories at Zomba were nearing completion while Zomba Experimental Station was equipped with a curing barn, implement shed, seed store, fertiliser store, office, school-room and cattle shed. At the Mlanje Experimental Station, the dwelling house was finished and put into occupation, the laboratory building was near completion, a hydraulic ram for water supply to house and laboratory was installed, and clearing and planting of the experimental area was well in hand. At Port Herald, the district officer has been provided with two sheds on the main experimental station, a guest house at his quarters and with store, office and native quarters on the *dimba* sub-station. In Karonga, clearing of land for the re-opening of the experimental station was undertaken, and at the new Lilongwe station and sub-station clearing and opening work was done, experiments were laid down and curing barns, a bulking and grading shed, seed store, implement shed, office and native quarters were completed. Coffee plots for purposes of demonstration and distribution of seedlings, cover crops and the like were opened in Cholo and at Zomba and nurseries were laid down in North Nyasa. The progress of the Colonial Development Fund work was well maintained, and thanks are due to the Public Works Department for its share in the efforts made during the year under review.

Nyasaland Tobacco Association.—The executive committee, of which the Director and Assistant Director of Agriculture are members, considered matters of importance to the European side of the industry, for example, the need for new markets, ridge-terracing of land, recommendations regarding fertilisers for bright tobacco, the observance of the uprooting rules and the financing of a trade representative in London. At the same time, close touch with the Empire Tobacco Federation was maintained. Out of a survey of the position of the European industry there arose the appointment of two sub-committees of the association which dealt with fertilisers and marketing respectively. The former held several meetings under the chairmanship of the Assistant Director of Agriculture, and its conclusions and recommendations were published in bulletin form for the guidance of planters. The latter, under the chairmanship of the writer, went fully into the questions of disposal of surplus leaf through the finding of new outlets for it and arranged certain trial consignments and samples. It is not yet possible to say what degree of success has attended the efforts of the committee, but it is perhaps a hopeful sign that its work is being continued in 1934.

Nyasaland Native Tobacco Exporters' Association.—As the mouthpiece of the buyers and exporters of native-grown tobacco this association continued to work in harmony with the department and the Native Tobacco Board which had the benefit of its opinion and advice on the opening dates for buying, the working of Northern Province markets in pairs, increased supervision in the Southern Province, tying of low-grade leaf, licence fees and condition of leaf in the markets. The association also appointed a committee to enquire into the possibilities of entering the West African market.

Tobacco.

The tobacco production of the year under review is given in the following table and the figures of 1932 are given for comparison.

Production

	1932		1933	
European-grown	lb.	lb.	lb	lb.
Flue-cured	3,549,168		2,304,400	
Fire-cured	2,317,840	6,252,288	717,136	3,488,016
Air-cured	385,280		466,480	
Native-grown				
Fire-cured		13,225,490		9,131,911
		19,477,778		12,619,927

It will be noted that production decreased considerably in 1933. The decrease affected both European-grown and native-grown leaf in the bulk and flue-cured and fire-cured kinds in particular. The production of air-cured leaf continued to increase. The fall in production of flue-cured and dark-fired European leaf was due to lack of demand and economic conditions while the reduction of native fired leaf was brought about by the Native Tobacco Board as a matter of policy.

The export figures, as is only to be expected, show a decrease in flue-cured and fired leaf and an increase in air-cured leaf. The figures are compared with those of 1932 in the following table.

	1932		1933		Increase or decrease
	Amount lb.	Value £	Amount lb.	Value £	lb.
Exports					
Flue-cured	2,260,500	84,769	1,644,479	61,668	− 616,021
Fire-cured	12,655,092	474,566	7,925,623	297,211	−4,730,469
Air-cured	166,443	6,241	824,396	30,915	+ 657,953
	15,082,035		10,394,498		

Of the amount actually exported in 1933 native-grown tobacco accounted for 7,172,204 lb. or 69 per cent of the total while European-grown leaf accounted for 3,222,294 lb. or 31 per cent. The corresponding percentages in 1932 were 61 and 39.

European.—European acreages and yields are given by districts in annexure H. The crop was disposed of as follows.

	Flue-cured lb.	Fire-cured lb.	Air-cured lb.	Totals lb.
Sold locally ...	1,395,184	610,736	285,600	2,291,520
Exported direct ...	290,304	16,688	163,632	470,624
Left on hand ...	618,912	89,712	17,248	725,872

The following table shows the 1933 totals compared with those of 1932.

	1932 lb.	1933 lb.	Increase or decrease. lb.
Sold locally ...	4,619,664	2,291,520	—2,328,144
Exported direct ...	732,256	470,624	— 261,632
Left on hand ...	900,368	725,872	— 174,496

The only gratifying feature of these figures is the increased production, local buying and export of air-cured tobacco. The air-cured market is worth attention, but increased production and export of air-cured leaf will not help much if prices fall to unremunerative levels. The flue-cured industry is in a desperate state owing to lack of demand and falling prices. It is realised that quality must be maintained and, despite the lack of encouragement, every effort is being made to maintain and even improve it, as witness the labours of the Fertilizers Committee of the Tobacco Association and the improvements in field methods that have been adopted, but it is also realised that something more is required, viz., the cheapening of the leaf on the home market and the finding of new outlets. Growing costs have been reduced in recent years, and it now seems essential that transport costs, both to the coast and by sea to Europe, should also be reduced. With regard to new outlets for flue-cured tobacco, a Marketing Committee of the Tobacco Association was set up during 1933 and, though it has not met with immediate encouragement, it is continuing its efforts. In fire-cured leaf the position of the European planter is equally bad. In 1932 he sold and exported 2,157,008 lb.; the corresponding figure for 1933 was only 627,424 lb. Prices are unremunerative and the native grower will soon be left in undisputed possession of the fire-cured market. It is difficult to understand the reasons for the state of affairs. On the one hand, Nyasaland darks may be suffering from competition with cheaper growths and price may be regarded as of greater consequence than quality, but, on the other hand, the percentage of usings of Empire tobacco to all other tobaccos continued to increase in 1933 and the deliveries of Nyasaland leaf for home consumption and for export from the United Kingdom and Northern Ireland in 1933 exceeded those of 1932 by 930,164 lb. If Nyasaland dark-fired leaf is merely suffering from other Empire competition, then its price must be lowered and kept down while its quality must be maintained, but, if it is suffering from a general over-production of dark tobacco, the time has come to consider the question of restriction of production of fired tobacco on an all-Empire basis. On the point of overproduction in Nyasland, it may be noted that stocks of Nyasa leaf in the United Kingdom at the end of 1933 amounted to 2 years and 8 months' supply based on 1933 deliveries, an amount which is not considered to be excessive by some authorities. The actual amount in stock was 32,234,603 lb. In this figure there is no differentiation between bright and dark leaf, and, as the information will be helpful, it is pleasing to be able to record that the efforts of the Empire Tobacco Federation to obtain a division of tobacco into bright and dark in the home customs returns have been successful.

Native.—The amounts of native-grown tobacco which were purchased in 1933 from Crown-land and private-estate growers in the various districts were as follows.

	Northern Province			Southern Province	
	Crown land lb.	Private estates lb.		Crown land lb.	Private estates lb.
Lilongwe ...	2,192,916	989,747	Mlanje ...	860,599	16,747
Dowa ...	1,604,783	282,969	Cholo ...	18,900	7,308
Kota Kota ...	106,259	—	Blantyre ...	445,068	111,464
Dedza ...	482,070	—	Chiradzulu ...	435,140	447,319
Fort Manning	26,219	209,428	Zomba ...	140,825	428,947
Ncheu ...	129,627	162,784	Upper Shire	32,792	—
	4,541,874	1,644,928		1,933,324	1,011,785

The quality of the crop was disappointing in the Northern Province and above the average in Southern Province. Weather conditions were largely responsible for the quality and yield of the Northern Province crop. The rainfall in the critical month of February was over 50 per cent above normal and temperatures were frequently two degrees below the night and day temperatures of good seasons.

Registered growers numbered 40,088 in the Northern Province and 6,524 in the Southern Province. These figures represent increases of 5.1 and 8.8 per cent over the figures of 1932 and are partly due to more stringent registration. The prices paid to Crown-land growers were estimated to average 2⅜d. per lb. in the Northern Province and 1¾d. per lb. in the Southern

Province, and the total sums paid to growers were respectively £44,946 and £14,097. These sums compared badly with the sums for 1932 which were £71,300 and £20,348. The average amount of leaf produced by Crown-land growers was 113 lb. in the Northern Province which brought an average of £1-2-4½ and 296 lb. in the Southern Province which represented £2-3-2. Buying in the Southern Province commenced in April while the buying stations of the Native Tobacco Board in the Northern Province were opened on May 15. The total number of buying licences was 124. The following table gives the amounts of Crown-land tobacco which were sold in the stations of the Native Tobacco Board in the Northern Province.

	lb.
Nathenje	700,435
Lombadzi	797,274
Mponela	1,290,047
Malenga	106,259
Mudi	314,736
Likuni	695,207
Tiwi	482,070
	4,386,028

The Native Tobacco Board continued its intensive supervision of Crown-land growers in the Northern Province and improved the supervision in the Southern Province. Private-estate growers produced 2,656,713 lb. as against 2,716,088 lb. in 1932 while Crown-land production, which is the concern of the Native Tobacco Board, was reduced from 10,509,402 lb. in 1932 to 6,475,198 lb. in 1933. This reduction was made by the board after a survey of market conditions and as an attempt to fit supply to demand. As far as any effect it may be expected to have on prices is concerned, it does not seem to have been successful in arresting the steady fall of the past few years.

A new experimental station was opened in the Lilongwe area. Its work will deal with dark tobacco in relation to food crops and with the soil treatment and yield of small grains with reference to rotations, organic matter and artificial manures. It is under the charge of Mr. Antill, Agricultural Superintendent of the Native Tobacco Board, and its influence has already made itself felt in district work which aims at the encouragement of terracing as an anti-erosion measure in native gardens.

Cotton.

Native.—The production of seed cotton by districts in 1933 was as follows:

Lower Shire 2,012½ tons; an increase of 38½ tons over 1932
Chikwawa 821 tons; an increase of 139 tons over 1932
Central Shire and Blantyre 159½ tons; an increase of 117½ tons over 1932
Ncheu 77 tons; none grown in 1932
Dedza 5 tons; none grown in 1932
Liwonde 4½ tons; none grown in 1932
Total 3,079½ tons; an increase of 381½ tons over 1932.

The total amount of seed issued was 422 tons, 392 tons of which were issued on the Lower River. This latter figure shows an increase of 210 tons of seed issued for an increase in crop production of 177½ tons of seed cotton. This season the seed issues were not restricted and these last two figures show clearly the need for checking the seed waste that goes on. Production per lb. of seed issued was 6.6 as against a production of 14.5 in the preceding year. The whole country was supplied with *U4* seed.

The number of gardens on the Lower River increased from 13,102 in 1932 to 25,108, an increase of 92 per cent. The size of the average garden was estimated to be 1.42 acres and the average yield per acre 350 lb. of seed cotton with maximum and minimum yields of 1,300 and 70 lb. per acre. These figures do not include the gardens that were abandoned through locust attack and the figures are only approximate. The total crop for the country produced 5,751 bales of lint and the percentage of lint to seed cotton was 33⅓. The Lower River crop was purchased by the British Cotton Growing Association and Captain R. E. Clegg and in other districts by the former only. Opening prices on the Lower River were $\frac{7}{8}$d. per lb. for no. 1 grade at the Port Herald and Chiromo ginneries and $\frac{3}{4}$d. per lb. at the outside markets. These prices quickly dropped to $\frac{3}{4}$d. and $\frac{5}{8}$d. and then to $\frac{5}{8}$d. and $\frac{1}{2}$d., recovering again later in accordance with home market prices. The highest price for no. 2 grade was $\frac{5}{8}$d. at Port Herald and Chiromo and outside stations; the lowest prices were $\frac{3}{8}$d. at the former and 5/16d. at the latter. The percentage of no. 1 grade was still high at 90.47. Last season it was 92.97. It will be interesting to see whether these percentages decrease with earlier planting.

The cotton season was not a particularly successful one owing to short rains and locust damage. It is becoming increasingly evident that a great deal of the Lower River is not particularly suited to cotton production and that no heavy yields can ever be expected from the light-land (*mpala*) gardens there. In 1933 the unsuitability of such land was very marked and the dangers attendant on late planting on all types of soil, including the heaviest, were apparent. With the complete absence of floods and early cessation of the rains the Ndindi marshland was drying and cracking by June and the crop there was finished by the middle of September instead of bearing, as usual, well into October. In *dimba* land January planting instead of March planting would have made a difference of some 500 tons of seed cotton.

Until an economic substitute can be found for cotton, and after, much work remains to be done in the district in the native garden under native conditions. Groundnuts are a very desirable substitute for cotton on the light lands bordering the hills, but the native cultivator is not likely to make the change a permanent one unless the new crop provides him with the same amount of money for work done as the old. Demonstrations of relative values and of new seed and varieties should and will be carried out under native conditions.

European.—The acreage under cotton was 246, and the production was 682 cwt. of lint.

Tea.

The following table gives acreages and details of tea production for the past two years.

	Total acreage	Acreage in plucking	Total production	Amount exported	Amount sold and used locally
1932 ...	12,595	7,271	2,689,984 lb.	2,573,871 lb.	—
1933 ...	13,830	8,251	3,049,760 lb.	3,276,477 lb.	94,864 lb.

The total acreage is divided between Mlanje and Cholo districts, the former having 8,440 acres and the latter 5,390 acres. The increase of acreage in 1933 was 1,235 acres of which 23 acres were in Mlanje and 1,212 acres in Cholo. The acreage figures are collected at the end of the calendar year, but they refer to the end of the planting season rather than to the end of the year and are therefore an under-estimate. For the sake of accuracy, tea statistics should be collected in July, that is, according to the season. Production increased by 359,776 lb. and, as has been shown in an earlier table, exports increased by 702,606 lb. or a little over 27 per cent.

Prices of Nyasaland tea improved considerably during the second half of 1933 as a direct result of the operation of the international tea restriction scheme which came into force on April 1. Nyasaland tea planters signified their approval of and adherence to the scheme, but actual restriction of exports or production was not imposed upon them as it was imposed on the tea interests of India, Ceylon and the Dutch East Indies. It was also understood that the stand-still agreement affecting increases of acreage in the east was not to be applied to East Africa, but the question of the amount of extension of tea acreage to be allowed to East Africa during the five-year period of restriction has been re-opened and is under discussion at the moment of writing. It is felt in influential quarters in Nyasaland that the acreage offered by the international restriction committee to East Africa to cover extensions of tea growing for the period of restriction is a generous allowance when compared with the stand-still agreement of the east, but it is not yet known whether it will be accepted by all East African interests and how it will eventually be distributed among the tea-growing countries.

The work of sending to the Imperial Institute samples of made tea for examination and report with a view to correlating variations in factory practice with quality and prices was continued. Over sixty samples were sent, and it is hoped to have a final report in early 1934 from which practical conclusions can be drawn.

The Mlanje Experimental Station for tea work was opened in 1933. Land was cleared, terraced and planted with Indian jat plants, and an area of 30 acres of old tea which was put at our disposal by the courtesy of Ruo Estates Limited was taken over. The scheme of work includes investigations dealing with manuring, making and use of compost, shade, cover-crops, green manures, pruning and plucking. Great interest has been displayed in regard to compost making and using.

It is a gratifying feature of the tea industry that, despite the lack of manuring and the fine plucking of 1931-32, yields of green leaf and the consequent out-turns of made tea have increased of recent years. Figures have been supplied which show increases of sectional out-turns varying between 25 and 82 per cent over the last three plucking seasons and increases of whole estate out-turns of 45 per cent in one case and 47 per cent in a second case over the same period.

Coffee.

Arabica coffee is now growing under a variety of conditions in Cholo and Zomba districts. Soils have been examined for organic matter, nitrogen and pH values. Observations on growth indicate that coffee does not succeed as an economic crop in the above areas when organic matter is low and pH values are below 5.8, while irrigation, which is of value on certain soils, will not prove of great help to coffee on soils with a low pH. Observations on various types of shade show that shade is of value under the dry conditions largely prevalent in Zomba, and the white stem-borer seems to be most prevalent on coffee growing in poor soils with a low pH.

The following table shows the acreage under coffee, the local production, amounts sold locally and amounts exported over the last three years.

	Total acreage	Acreage in bearing	Production in cwt.	Amount sold locally in cwt.	Amount exported in cwt.
1931 ...	1,542	600	1,175	—	834
1932 ...	1,449	531	767	241	788
1933 ...	1,210	618	1,128	458	357

The coffee growing industry is a shadow of what it was twenty years ago. It will be noted that while total acreages have been falling, the acreage in bearing has increased slightly between 1931 and 1933. Efforts to revive the industry are being made.

Other Agricultural Produce.

Rubber tapping was not possible in 1933 and local sisal acreages are now out of action. European agriculturists had 23 acres under chillies, 2,017 acres under maize, 82 acres of wheat, 3,630 acres under legumes, 101 acres under oil-seeds, 194 acres of fruit trees and 54 acres of nut-bearing trees. Artificially established woodland was reported to amount to only 14,622 acres against 16,155 acres in 1932, the Blantyre district alone showing a decrease of 1,355 acres.

Tung Oil.

The total plantings of tung oil now amount to 65 acres. Four samples of fruits of *Aleurites Fordii*, provided as before by the Conservator of Forests, were sent to the Imperial Institute for a second report on the oils. Three of the samples were from first crops and the fourth was from a second crop. The oils were reported to be of good colour and low acidity. The gel produced in the standard heating test was of uniform quality with just under 20 per cent solubility—a satisfactory figure. The iodine value and refractive index of the oils were about average for oils of plantation-grown trees according to the species. The products of all plantation-grown trees in general are said to be superior in these respects to the market product of today.

This report and that of last year are regarded as giving encouragement to the planting of small areas of *Fordii*, say, 10, 15 or 20 acres, but, at the same time, it should be understood that, although oil tests have been satisfactory, the commercial exploitation of tung oil trees in Nyasaland has not yet been proved to be financially successful. Although it is unlikely that the production of *montana* oil will receive the same encouragement as that of *Fordii*, it is intended to send 1934 *montana* seed to the Imperial Institute for an oil test.

Native Food Crops.

From the weather report for the season it will be deduced that food-crop yields were good everywhere. Locust infestation was heavy in a few areas, hoppers doing considerable damage to the grain crops, but over the greater part of the Protectorate growth was good and food supplies to the end of the year were plentiful.

Maize remains the principal food crop of the country and constitutes in native hands fully 70 per cent of the cereal production. *Sorghum vulgare* in its numerous varieties forms 9 per cent, rice 8 per cent, pearl millet (*Pennisetum spicatum*) 5 per cent, finger millet (*Eleusine coracana*) 3 per cent, and various small millets such as proso, shama and foxtail, together with small grains such as wheat in the highlands, make up the remaining 5 per cent of cereal production.

The maize crop throughout the country was good with the exception of the areas already mentioned, and in many districts the grain was so plentiful as to be practically unsaleable in the local markets. On the Lower River, maize, principally grown on the heavier types of soil, is planted from November onwards. The main crop of the season was harvested by March and gave an excellent yield. Sowings up to the end of January did well, but later sowings, owing to the short rainfall and rapid drying out of the dimbas, gave poorer yields. In North Nyasa the yields were on the whole poorer than those of last season, in part owing to the late planting forced on the natives by their early locust-control work and in part due to the early cessation of the rains. No experimental work on maize was carried out in 1933 at the experimental stations. The soil of the main (*mpala*) station at Port Herald is too light and sandy to carry a maize crop except in exceptionally wet years and the interplanting trials on the *dimba* sub-station were visited by locusts and entirely destroyed. Spacing and interplanting trials have been included in next season's cropping schemes.

The early planting conditions on the Lower River were favourable to the millet crops and early growth was good. In areas where locust infestation was heavy, pearl millet was reduced in amount, seriously in places, and the sorghum crop was entirely destroyed. Where there were no locusts heavy yields of pearl millet were obtained, but the crop suffered from severe bird attack once the grain began to form. Stem-borer and smut took their toll, and, speaking generally, the season was a poor one for the sorghum crop. In North Nyasa millet yields were lower than last year for the reasons already given in the case of maize, late planting and a short rainy season. The finger millet crop on the Lower River was harvested in May and the yield was good. In some areas the parasitic witch weed, *Striga* spp., infested the sorghum and finger millet gardens but on the whole was not so prevalent as in former seasons. It should be mentioned here that the excellent Lower River finger millet crops are obtained without any previous bush destruction. Neither seed beds nor gardens are ever "burnt over" and the native in those parts seems to be quite indifferent to the method of preparation by fire. In the Northern Province the cultivation of finger millet is responsible for a considerable amount of woodland destruction every year, but from Lower River practice it is apparent that this destruction is unnecessary and that excellent crops can be obtained by employing on this millet the same native methods of cultivation as on the other millets.

The rice crop was smaller in 1933 than in the previous year. Everywhere, particularly along the lake shore, areas were reduced because of the locust menace and in August the District Agricultural Officer reported a much reduced crop from North Nyasa. As is usual in the case of acreage reduction, the yield per acre was as high as, if not higher than, usual, but reports also stated that later-planted gardens gave very poor yields. The following figures give details of the production and disposal of the rice crop in the various districts.

District	Purchased by Government	Purchased by others	Consumed by natives	Exported by Government	Exported by others	Total production for district
	tons	tons	tons	tons	tons	tons
Kota Kota	100.0	25.0	50.0	—	—	175.0
North Nyasa	22.0	18.0	—	—	—	40.0
Dowa	—	—	5.0	16	7	28.0
Dedza	7.5	10.0	—	—	—	17.5
Chinteche (West Nyasa)	13.9	2.3	—	—	—	16.2
South Nyasa	7.5	7.5	—	—	0.5	15.5
				Total production		292.2

On the Lower River rice yields were very poor, many gardens on the Ndindi marsh drying out completely. In this part of Nyasaland the comparative failure of the rice crop is of little importance. Rice does not form any part of the native dietary and is grown solely for sale to the Indian traders, whose food it is. Such a market is of course purely local and the demand is very limited. Unless rice becomes a part of the native dietary or can be profitably exported, it will be unwise to encourage natives to increase their rice area on the Lower River. Some of the varieties grown are of excellent quality and yield well; most of them are pale-skinned. Experimental work on rice will be carried out on the Port Herald *dimba* sub-station next season.

Throughout the country the groundnut crop was fair and in certain districts excellent. In the Lower Shire district a trial export consignment of 10 tons was obtained by the African Lakes Corporation with some difficulty. The original price offere d to the native grower was 1d. per 3 lb. but it had to be raised to 1d. per 2 lb. before the nuts could be bought and even then it was three months before the consignment was completed. The local demand in Nyasaland for groundnuts for soap and oil manufacture has led the native grower to place too high a value on his crop. The crop does not suffer from disease except when planted too late. When this happens *rosette* disease is liable to attack the plants but the damage done is never great nor widespread. A certain amount of leaf spotting and discolouration caused by *Cercospora personata* is evident every year but it is usually negligible and has never been recorded as being of importance. Both troubles occurred in the past season. *Spanish Bunch* seed was distributed to native growers from the Port Herald Experimental Station and a small trial plot of *Japanese Bunch* gave promising results.

With the exception of groundnuts, oilseeds are of minor importance in the native crop list. Simsim is almost universally grown but always in very small patches, generally on the ash heap outside the hut. There is always a small local demand from Indian traders who express the oil for cooking purposes. Castor oil grows wild in almost all parts of the country and the natives extract the oil in the crudest way for use on their bodies.

PART II—Work of the Department of Agriculture.

District Work.—Details of district work will be found in annexures A-C. Owing to the arrival of Mr. B. C. G. Charles on first appointment as District Agricultural Officer, it was possible to again station an officer in North Nyasa and resume the work began by Mr. Barker and interrupted by his transfer to Port Herald in May 1932 to take the place of Mr. Lawrence who was due for leave.

Every possible effort is being made to improve the native grain crops and, in view of the unevenly balanced nature of the usual native diet, to extend the range of other food crops. Attempts are being made to encourage the growing of crops that will convey to the native diet an increased amount of protein, and in this connection soya beans are of great importance. Not only do they supply a desirable amount and type of protein but they have a distinct value in rotation and land renovation. They are one of the many legumes which have been successfully introduced at the Zomba Experimental Station during the last six years and have also been tried at Port Herald.

Experimental work on sorghum which consisted of spacing and borer-control trials and of observation plots of various interplantings was a complete failure at Port Herald owing to the damage done by the red-winged hopper attack in March and April and will have to be repeated. Various interplanting trials with pearl millet, legumes and cotton gave interesting results and are worthy of repetition. The Lower River native seems to appreciate the selection work that has been done on pearl millet, and during the last planting season he exchanged just over two tons of his own seed for seed from the experimental station at Port Herald. Trials of the lesser millets, proso, shama and foxtail, have been made, and seed stocks are held in readiness for relief measures should they become necessary.

A fair amount of attention has been given to pulse crops. Now that the importance of soil conservation is realised as never before, the need for more definite knowledge of pulse crops is evident since they are the most useful of the native food crops in this connection. Various trials have shown that not enough is known concerning the best times of planting, and much work is waiting to be done. Observation plots of mixed crops have shown that grains and legumes can be profitably grown together in certain mixtures but not in others. A close study of native methods at Port Herald has shown that the native's practice of growing millets, cotton and legumes in the same garden is very sound when the time at his disposal for agricultural work, his way of living and his fear of hunger are taken into consideration. The mixtures, the seed and the methods are

certainly capable of improvement but the fundamental idea of mixed cropping is sound. From the point of view of soil conservation, some useful crop mixtures have been tried and found satisfactory. They will be used on demonstration plots at the training school for native instructors at Makwapala.

Coffee growing has been encouraged in Cholo and Zomba and nurseries laid down for distribution of coffee plants, green manures and shade trees. References to other lines of district work will be found under the headings of tobacco and tea.

Agricultural Survey of Central Nyasaland.—A survey of central Nyasaland, that is, the area extending from Blantyre in the south to Domira Bay in the north and traversed and tapped by the northern extension of the railway, was carried out with the aid of locally-recruited qualified men and at the expense of the Colonial Development Fund. The field work was done by Messrs. A. C. Williamson, C.D.A., H. N. Percival, N.D.A., R. G. Houston, N.D.A., W. L. Maxwell, W. W. Needham, (part time) and F. E. Widdas (part time), and the office and mapping work was done by Capt. J. W. Guise. The whole was under the direction of the Assistant Director of Agriculture at a time when he was acting as Director of Agriculture. Much useful information regarding soil types and their distribution, water supplies and the general potentialities of the area was acquired, and the work will have an important bearing on the economic development of central Nyasaland in general and on the water-supply work of the Geological Survey, the problem of relief of congested areas and the question of freight for the northern extension of the railway in particular. It is hoped to publish the report of the survey and a land utilisation map in 1934. Reference to the field and laboratory work on soils of the surveyed area will be found in annexures D and E and under *Chemistry and Soils.*

Chemistry and Soils—Capt. Hornby's energies were diverted for most of the year under review from laboratory to administrative work, and laboratory work on soils, particularly the soils of the area of central Nyasaland which was specially surveyed, was carried out by the Assistant Agricultural Chemist. The full reports of Capt. Hornby and Dr. Armstrong Black are to be found in annexures D and E.

Preliminary examination of soil samples obtained from the survey was done by rapid methods, the objects of which were (1) to endeavour to find simple criteria for judging the similarity or dissimilarity of soils from different areas, (2) to investigate the possibility of classification of soils on the results of the rapid methods, and (3) to make an eventual comparison between the rapid methods and the more laborious standard methods and thus assess the absolute value of the former methods when applied to Nyasaland soils. In this connection the rapid carbon determination may by regarded as specially tentative since it has been checked in comparatively few cases. Its advantages are ease and speed of operation. Under comparison, it has given results equal to those obtained by other wet-combustion methods. It awaits further investigation by comparison with results obtained with the new combustion furnace.

The ecological-soil work done in collaboration with the Forestry Department is in its very early stages, but it may prove to be of practical value in connection with soil types and forest types and their relationships. As will be seen from annexure D and Bulletin No. 9, the meteorological work of the past ten years and more is now bearing fruit in the shape of a division of the country into agricultural zones.

The work of the Zomba Experimental Station was continued on the former lines, and it is now being duplicated in Lilongwe. An account of the work will be published in a form which will show the lines followed and the results obtained. Attention is drawn in annexure D to the importance of organic matter and to the work done on Indore compost. It is gratifying that the work of the chemists in the preparation of tobacco for the West African market was attended with a fair amount of success.

Entomology.—As will be seen from annexure F, the need for general study of the locust invasion and control of the measures taken against the pest left the Entomologist little or no time for work on crop pests. Nevertheless his report contains interesting references to tobacco pests, to new records of the coffee white stem-borer on tea and wild plants, and to the need for control of citrus pests.

Up to the time of the present outbreak of the red-winged locust no comprehensive study of this species had been made and the available knowledge of its habits and life-history was extremely meagre. In addition to the necessary work on the control of the pest, the Entomologist has obtained a considerable amount of new information on the bionomics of this locust, in both the hopper and adult stages, which will appear, it is anticipated, in a more suitable publication. The present report refers to the invasion of, and development within, the Protectorate, to the combative measures adopted, and to the feeding habits and the fungus disease of the locusts. With regard to anti-locust measures, Capt. Smee's report makes clear the policy of garden protection which was adopted as a basis for the work. The measures were successful on the whole, and for their success the credit is due to the temporary European locust officers employed by the department and the officers of the district administration.

Mycology.—Mr. Leach's full report will be found in annexure G. Although much of his time between his return from leave in April and the end of the year was occupied with the opening, clearing and planting of the new experimental station in Mlanje, he continued his work on *Armillaria* root disease and opened up what may prove to be a useful and practical line of work in regard to the conditions required for the successful storage of tea seed in Nyasaland. The preliminary results are both striking and encouraging, and they give ground for the hope that conditions applicable to seed in bulk will be disclosed. It will be noted with regard to tea *yellows* that the disease is expected to be of small importance by the end of 1934 provided the recommended treatment is continued.

Botanic Gardens, Zomba.—The work of soil improvement in the gardens through manuring and growing of legumes, especially pigeon pea, was continued. Part of the gardens was used as a plant introduction station, particularly for trials of citrus recommended by Professor Clark Powell and Mr. H. E. V. Pickstone and for new varieties of sugar cane. The gardens contain several economic plants of recent introduction, and, as they are neither botanic gardens in the accepted meaning of the name nor an attractive pleasure ground, there is much to be said for their being used solely as a plant introduction station.

Plant Introductions.—Various citrus types were introduced from Southern Rhodesia and South Africa, and trials are being made on three types of soil near Zomba and in areas of the Namadzi-Kwakwazi-Tuchila river system in which an irrigation survey was done by the Public Works Department.

Efforts to improve native crops were helped by the kindness of the Department of Agriculture of Southern Rhodesia which provided new varieties of maize, soya beans, wheat and sweet potatoes, and the development of the local range of economic crops was assisted by gifts of seed of *Bassia* and tung oil, essential oil plants, lime seeds, new types of castor oil and non-shattering soya beans from other departments and institutions. These introductions are all doing well.

Cashew nut and simsim seeds were purchased, the latter in quantity, and were distributed in the Lower River and along the northern extension of the railway. A wide range of fibre plants is now growing well on the Zomba Experimental Station and recent introductions include manila hemp (*Musa textilis*) and New Zealand flax (*Phormium tenax*).

Publications.—The following departmental bulletins were issued during 1933.

No. 6 *Proceedings of the first and second meetings of the Board of Agriculture held on December 7, 1932 and April 5, 1933.*

No. 7 *Proceedings of the first and second meetings of the Fertilisers Sub-committee of the Nyasaland Tobacco Association held on April 19 and 26, 1933.*

No. 8 *Citrus fruit prospects in Nyasaland (report by Professor Clark Powell.)*

No. 10 *Proceedings of the third meeting of the Board of Agriculture held on November 10, 1933.*

Of these bulletins, nos. 6, 7 and 10 were issued for local circulation only. Dr. H. H. Mann's report on the tea industry was published by the Crown Agents for the Colonies and was warmly welcomed in Nyasaland.

Staff.—The following officers were on leave in 1933. Mr. R. Leach, Mycologist, from January 1 to April 20, Mr. E. Lawrence, District Agricultural Officer, from January 1 to February 22, Mr. F. Barker, District Agricultural Officer, from March 30 to November 27, Dr. W. Small, M.B.E. Director of Agriculture, from June 22 to December 31. From June 21 to December 31, Capt. A. J. W. Hornby, M.B.E., acted as Director of Agriculture, Capt. C. Smee, M.C., Entomologist, acted as Assistant Director of Agriculture, and Dr. I. W. M. Armstrong Black, Assistant Chemist, acted as Agricultural Chemist. Mr. B. C. G. Charles, District Agricultural Officer, arrived on April 7 on first appointment and was posted to North Nyasa with headquarters at Karonga.

Financial.—The following figures give an analysis of the cost of the operations of the Department of Agriculture during the year under review.

	Approved estimate		Amount spent
PERSONAL EMOLUMENTS:	£		£ s. d.
European staff	6,680	...	6,811 13 1
Native staff	584	...	528 8 7
	7,264	...	7,340 1 8
OTHER CHARGES:			
Transport, Travelling	624	...	546 3 8 / 12 15 9
Passages	602	...	798 12 11
Experimental Work	250	...	242 11 9
Distribution of Cotton Seed	130	...	225 9 11
Botanic Gardens	45	...	45 17 4
Contribution to Agricultural Shows	120	...	120 0 0
Treatment of Plant Diseases, Tobacco Pests, etc.	150	...	119 0 6
Library	20	...	9 16 2
Tools and Equipment	200	...	201 12 6
Seeds and Plants	50	...	42 13 6
Incidentals	22	...	18 10 0
Uniforms	13	...	13 14 9
Native Cotton Industry	100	...	90 0 0
Contribution towards Upkeep of Experimental Stations E.C.G.C.	500	...	500 0 0
Transport (E.C.G.C.)	215	...	213 16 5
	3,041	...	3,200 15 2
SPECIAL EXPENDITURE:			
Development of Export Crops	500	...	368 5 11
Visit of Citrus Adviser	250	...	211 4 10
Maize Moisture Testing Machine	66	...	37 7 6
Anti-Locust Campaign	—	...	1,145 0 5
	816	...	1,761 18 8
	11,121	...	12,302 15 6

PART III.—Work of the Empire Cotton Growing Corporation.

In the following general summary of the work of the Empire Cotton Growing Corporation for the season 1932-33 which has been written by Mr. H. C. Ducker and has been taken from the 1932-33 volume of annual reports published by the corporation, attention may be drawn to the mention of the suitability of the rainfall conditions of the Domira Bay area (in which the corporation's work is now concentrated) for the plant-breeding work which is an important and essential part of the activities of the staff. Seed of improved *U4* types of cotton has been distributed in the Domira Bay district and the crop will first provide a seed stock of high-yielding capacity for part of the Port Herald area and eventually for all the southern areas of the Protectorate.

Mr. Ducker's report is followed by a summary of experimental results which was written by Mr. Hoyle and is not reproduced here. It may be consulted, however, in the library of the Department of Agriculture.

Mr. S. T. Hoyle proceeded on home leave in December, 1932, and returned to Domira Bay in August, 1933; Mr. W. L. Miller proceeded on home leave in July 1933. Mr. H. C. Ducker took charge of Domira Bay during Mr. Hoyle's absence and on his return proceeded to Makwapala.

Mr. Ducker's summary is as follows. "Concentration at Domira Bay of the cotton experimental work under the direct control of the Corporation in Nyasaland is virtually complete. A total of 150 acres of land actually under cultivation is now cleared at this station, and from 1933 onwards the five-course rotation as described in the report last year will be in operation. This rotation provides for the annual cultivation of 60 acres of cotton, an area which it is believed will prove adequate for the work in hand. New works have been commenced to provide the necessary accommodation at Domira Bay, and a programme of building has been planned for completion this coming season which, it is thought, will satisfy needs for some years to come.

"The past season has confirmed the opinions given in previous reports as to the suitability of the Domira Bay area for cotton. The average yield of 250 lbs. lint per acre over the entire acreage at the station speaks for itself. The south-western lake-shore belt appears to possess particularly safe rainfall conditions, which should enable the cotton breeding programme to be carried on in a most satisfactory manner.

"Makwapala has had its last season as a cotton station and, though the cotton yields this past season were particularly good, there has been no evidence to show that previous opinions regarding its unsuitability for cotton-breeding work are in error. As is usual, the proportion of stained cotton was far higher at this station than at Domira Bay.

"Port Herald, now a government district station, suffered from a badly distributed rainfall, which was again on the low side for the sandy alluvial soil of this station. It was also somewhat badly afflicted by locusts.

"At Lilongwe a satisfactory mass selection plot was grown at the Likuni station. Some fifty single-plant selections, which matured sufficiently early for the conditions of this area, were taken. Locusts, in particular the red-wing species, were a cause of considerable anxiety throughout the year. While in general they did but little direct damage to cotton, this crop tended to be neglected by the natives in favour of the threatened food crops. The cotton at Domira Bay was not directedly attacked until somewhat late in the season, when it was invaded by young flying swarms. These did considerable damage to the top crop and caused a loss which is estimated at 25 lb. lint per acre.

"The good returns from the cotton at Domira Bay have provided a stock of seed of improved *U4* types which will suffice for an area of not less than 1,000 acres. Arrangements have been made to issue this seed stock, under controlled conditions, to native growers in the Domira Bay area instead of the station seed being sent to Lisungwe as in the past. It is hoped that the resultant crop will be sufficient to flood the southern section of the Port Herald area in 1934-35, and provide stocks for the whole of the southern cotton areas in 1936.

"The issue of a mixture of high yielding *U4* types, of similar lint character, is thought preferable to the issue of separate strains at this stage in the work."

The financial contribution of Nyasaland to the work of the corporation in 1933 amounted to £713 16s. 5d., £500 being devoted to experimental work and £213 16s. 5d. to travelling.

PART IV.—Native Tobacco Board.

The principal matters before the board during 1933 were the economic aspect of native Crown-land production, the control of the amount of production, the grouping of buying stations in the Northern Province, the closing of Malenga buying station, the reduction of the buying tax, the period of validity of buying licences, options on buying booths, increased supervision in the Southern Province, and reduction and re-organisation of staff. The board continued to finance experimental work at Zomba and Lilongwe.

Mr. Clegg left the service of the board and Mr. Burton acted as Agent from August 3 to December 31. Mr. J. A. Miller was appointed temporary Supervisor from August 4 to December 31. Capt. Antill entered upon his new duties as Agricultural Superintendent and took charge of the development of the new experimental station at Likuni near Lilongwe.

The following members of the staff of the board were on leave: Mr. J. W. Pryor from January 1 to March 9, Mr. R. E. Clegg from January 1 to April 7, Capt. R. M. Antill from January 1 to January 2, Mr. W. P. Tylor from July 7 to December 31, Mr. F. F. Smithyman from July 28 to December 31, Mr. R. E. Jackson from August 5 to December 31, Mr. A. G. H. Du Frayer from August 1 to December 4 and Mr. A. B. Cormack from August 18 to December 31. During the writer's absence on leave, Capt. A. J. W. Hornby as acting Director of Agriculture assumed the chairmanship of the board, and Capt. Smee was co-opted as a member. The other members of the board were the Treasurer and afterwards the Acting Treasurer, the Honourable Mr. W. Tait-Bowie, O.B.E. and Mr. A. F. Barron, O.B.E.

The financial statement for 1933 will be found in annexure I.

Tne writer wishes to express his appreciation of the work of the British Cotton Growing Association and the Empire Cotton Growing Corporation and to thank their staffs, the members of the staff of the Department of Agriculture and the members and staff of the Native Tobacco Board for their work and general helpfulness. Special thanks are due to Blantyre and East Africa Ltd. and to Mr. R. C. MacGrath of Bandanga Estate for their helpfulness in connection with the coffee plot in Cholo.

W. SMALL,
Director of Agriculture.

Annexure A.

Report of the District Agricultural Officer, Lower Shire and Chikwawa (1).

The writer was absent from the Protectorate on home leave from April 1 to November 27. During his absence Mr. E. Lawrence was in charge of the station. Full details of the work for the year have been recorded, therefore, in the report rendered by that officer.

While on leave visits were paid to the Rothamsted Experimental Station, Harpenden, Herts, the Hannah Diary Research Institute, Kirkhill, Ayr, and to the Royal Botanic Gardens, Kew.

At Kew some further work was done on the Northern Nyasa varieties of rice and material was available from a complete collection of herbarium specimens which had been submitted for determination by the authorities there. Valuable assistance was rendered by the staff at the Herbarium and sincere appreciation of this and the facilities provided is gratefully accorded to the Director of the Royal Botanic Gardens.

Cotton.

At the commencement of the season indications were such as made it reasonable to suppose that a record year for production might be anticipated.

Table 1 which follows clearly shows very appreciable increases in both the number of gardens and of growers when compared to last year's figures. Columns 8a. and b. indicate how the degree of interest in cotton cultivation varies from section to section. The high percentage of growers to huts in certain sections is accounted for by the superior cotton soils carried as well as by the large number of female growers of the crop in those areas.

In face of the figures contained in columns 5, 7, 8a, 8b, and 9a, the total production would appear to be disappointing. It is only disappointing from the standpoint that but for adverse factors of locusts and short-fall in mid-season rains the crop produced must well have been a record one. These circumstances together reduced the factor of production per 1 lb. of seed issued from 14.5 in 1932 to as low as 7.4 for this season. If due regard be given to the presence of these adverse factors, then it is a matter for some congratulation that the crop was no less than the total amount realized. Ultra-late planting in the light *mphala*-land soils is still too frequently practised and active steps continue to be taken in order to eradicate this evil, the mal-effects of which are the more apparent in seasons of short rainfall on light and therefore less retentive soil. The native is ever slow to move from any practices he has come to adopt and it must be anticipated that this psychologic factor will bear on the rate of improvement towards earlier planting.

It will be noted that the average of acre yields of cotton produced in the Chiromo area was superior to that obtained in the Port Herald portion of the Lower River district. The unit factor of production per lb. of seed issued is also superior in the former area. Throughout the districts the same or very similar climatic conditions maintain. The use of *U/4* seed is universal and the crop is cultivated in precisely the same matter throughout. The one essential difference is that of soil. It has not been possible so far to conduct a really accurate soil survey but the range of varying agricultural conditions as a whole is sufficiently well known to essay very close approximations to what actually is the proportion of *dimba* (heavy or retentive soil) to *mphala* (light or non-retentive soil). An analysis of cotton gardens in the Chiromo area reveals that the proportion of gardens cultivated on the more retentive and therefore higher-yielding soils is as 8 is to 2 approximately. In the Port Herald area the approximate proportion is only as 3 is to 2. A very similar position applies in regard to the Chikwawa district when the lower yield per acre and lower unit factor of production of that district are each in turn compared to Chiromo area figures of acre yields and production factor. So divergent in character are *dimba* and *mphala* soils that their respective yields should not be subjected to comparison but rather to contrast of the superior cropping possibilities of the one with the other under any one particular crop. This applies particularly to cotton in seasons of short main rains and ineffective mid-season rains.

The soil characteristics of the two areas of Chiromo and Port Herald also quite naturally reflect the degree of interest which the native evinces in cotton cultivation in the two areas. It is therefore not unnatural that there will be greater response shown by the native to the cultivation of cotton or any other economic crop in those areas where the return for labour expended is best. He cannot be blamed for lack of interest where returns are poor for reasons beyond his powers to adjust. There must be many instances where the cultivation of groundnuts would have proved a more remunerative crop to the native farmer and it is the native farming the lighter type of land who will be encouraged to grow the latter crop under the present scheme for general development. It is unlikely that the growing of groundnuts will affect the present tonnage of cotton produced to any appreciable degree. The advent of groundnut cultivation on a more generous scale than that of the past may even indirectly benefit the cotton crop in certain areas. A general tendency would be for the lighter *mphala* garden soils to improve if put to groundnuts and this improvement might be exploited by cotton at a future date when a return to a higher rainfall cycle takes place.

As to the future of cotton production in the Lower River and Chikwawa districts, it is believed that with the present average price paid to the grower during the last two seasons we are not now wide of the saturation point of maximum interest. The really big growers are only likely to return if an appreciable increase in price eventuates. This does not seem probable in the meantime and little or no extension in acres under cotton can be hoped for from that source. There remains the small grower by whom the bulk of the crop is now and will continue to be produced. His outlook is entirely interwoven with what is naturally his major and primary agricultural duty, that of growing his food supplies. With that portion of energy then remaining to him he exploits the economic possibilities of his soil in a degree which varies according to the individual.

The average size of native cotton cultivations is 1.5 acres approximately and at the present juncture it seems unlikely they will be extended much beyond that figure. A slight improvement in acre yields will be reflected as extremes of late planting in the lighter *mphala* soils are checked. Propaganda together with groundnuts superseding cotton in these areas will adjust this. Education directed towards better cultivation of the crop will tend to steadily improve yields but a big increase in production will only result from increased acres as the result of a sudden improvement in cotton prices. With prices steady at 1d. per lb. for seed cotton the natives' present interest will not alter very appreciably and the success or failure of the annual crop will be circumscribed according to favourable seasonal conditions or otherwise.

Uprooting.

The destruction of cotton bushes at the end of the season was satisfactorily concluded. There were but 181 offenders or .8 per cent. approximately of the total number of native cotton growers. The surveillance of gardens is a big task for the limited native agricultural staff which is available for this work but the ready co-operation afforded by officers of the district administration has made it easier to ensure that the rules pertaining to uprooting and destruction of cotton bushes are complied with by the required date.

Locusts.

The districts were invaded by the red-winged species of lucust (*Nomadacris septemfasciata*, Serv.) early in January. This invasion came from the Zambesi valley and with the exception of the southern portion of the Lower Shire district below Port Herald infestation was heavy throughout. Considerable damage was done to both food crops and to cotton in the field. At one time it seemed inevitable that famine would result and the question of importing food for famine relief measures was seriously deliberated. It was decided later that by exploiting *dimba* cropping areas to the full under such crops as sweet potatoes, pumpkins etc., the situation might be met. This resort proved entirely satisfactory, and, although food was tight and unevenly distributed, the natives pulled through by their own resource in a remarkable manner. Cereal crops were exrtemely short and sweet potatoes became an almost staple dish towards the end of the year. To augment food supplies indigenous fruits, roots and grass seeds were also sought after; in fact, nothing was overlooked that was edible. For the coming season *dimba* production of sweet potatoes must play its part again and little encouragement is necessary to stimulate natives in that direction after their recent experience. With few exceptions natives did work hard in their efforts to minimise damage caused to gardens. In many cases praiseworthy attempts were foredoomed to failure so overwhelming were the odds against them. The mechanical destruction of locusts and their hoppers is a heart-breaking job but it is our sole means for the present of dealing with the pest and natives have been advised that they must protect their gardens how best they can. It is a *sine qua non* for them to do so in their own interests and little urging to that end should be necessary. For the coming season garden acreages have been somewhat increased to allow for possible losses due to locust attack.

Acknowledgements.

Messrs. Boby and Stephens rendered valuable assistance in connection with anti-locust measures. In connection with cotton seed distribution and planting propaganda these two gentlemen again did excellent work. The British Cotton Growing Association and their buyers have rendered much useful co-operation and assistance in their customary and courteous manner. A very definite cordial liaison with the staff of the Empire Cotton Growing Corporation exists and their collaboration in relation to experimental work on cotton is of great value. Thanks are due to all concerned for their work and ready assistance which is greatly appreciated.

Frank Barker,
District Agricultural Officer.

1	2	3	4	5	6			7	8 Growers to huts approx. per cent.		9 approx. per cent.		10	11
	Hut-owners in section	No. of growers 1932	No. of growers 1933	Increase from 1932	*a.* Large	*b.* Small	*c.* Total	Increase from 1932	*a.* 1932	*b.* 1933	*a.* Increase	*b.* Decrease	Total crop in lb.	Increase of crop over 1931-32 in lb.
LOWER SHIRE														
Mlolo	4,238	2,805	4,499	1,694	99	4,526	4,625	1,710	86	106	20			
Tengani	8,268	1,486	4,201	2,715	21	4,344	4,365	2,859	20	51	31			
Chipwembwe	2,277	917	1,264	347	6	1,284	1,290	353	57	55		2*		
Ngabu	1,782	518	1,000	482	9	1,175	1,134	670	41	56	15			
Chimombo	3,199	723	1,326	603	—	1,548	1,548	822	18	41	23			
Ndamera	4,370	642	1,906	1,264	26	2,085	2,111	1,438	15	44	29			
Nyachikadza	2,791	1,465	2,513	1,048	24	2,851	2,875	1,369	38	90	52			
Total	26,925	8,556	16,709	8,153	185	17,813	17,998	9,221	39					
				95%				105%	39 aver.	63 aver.	24 aver.	—	6,494,228	545,065 or 8½% approx. increase.
CHIKWAWA														
Chipatula	3,256	2,137	2,491	354	51	2,517	2,568	373	66	77	11			
Beleu	2,141	143	303	160	2	303	305	162	7	14	7			
Ngabu	3,646	1,061	1,596	535	11	1,594	1,605	535	29	44	15			
Kasisi	1,714	161	412	251	24	393	417	256	9	24	15			
John	1,192	452	794	342	4	810	814	354	38	66	28			
Daniel	1,131	152	399	247	21	378	399	247	13	35	22			
Katunga	886	143	450	307	20	436	456	312	10	50	40			
Total	13,966	4,249	6,445	2,196*	133	6,431	6,564	2,239						
				52%				52%	25 aver.	44 aver.	19 aver.			
CHOLO														
Ntondeza *	6,487	—	522	522	9	535	544	544	—	8	—			
Total Chikwawa and Cholo	20,453	4,249	6,967	2,718	142	6,966	7,108	2,783	—	—	—			
				64%				64%*						
Grand Total	47,378	12,805	23,676	10,871	327	24,779	25,106	12,004	—	—	—			
				85%				92%*						

Lower Shire and Chikwawa Districts

* (Decrease due to 44% increase in hut tax census. i.e. adult males)

* Cholo growers are not included in this figure. They have been separately recorded in 1933 but not previously.

* inclusive of Cholo

* includes Cholo

N.B. All figures per cent. are approximate.

Report of the District Agricultural Officer, Lower Shire and Chikwawa (2).

The writer returned from leave at the end of February and took charge of the district and experimental station on March 3. Mr. Barker went on leave at the end of March.

The services of Messrs. G. M. Boby and F. Stephens were retained by the department for cotton seed distribution during January, February and March, and once again the writer wishes to place on record his sincere appreciation of and thanks for the very real and generous help that they have given him not only when employed by the department but throughout the year. Regular rainfall records have been kept by them at Chiromo and Chikwawa, locust reports and Native Agricultural Instructors' reports forwarded whenever needed, and a hundred and one other services rendered to the department of which no adequate acknowledgment can be given here. His thanks are also due to the British Cotton Growing Association for the courtesy and help that he has received from them and from their native staff and to the various District Commissioners for their co-operation and support.

Work in the districts has been carried out for the third season on lines very similar to those of the preceding two. Any alterations or modifications are mentioned under the relative headings.

Meteorological.

Complete meteorological details are given in tables 1, 2 and 3 at the end of this report. Table 3 brings the records up to date and completes the data collected during the past seven years on the experimental station at Port Herald.

The rainy season began earlier in November than usual and by the end of December, the wettest month recorded for many years, most of the main grain crops had been planted and were showing good stands. In some areas maize in *dimba* gardens suffered from water-logging but recovered quickly during the last week of the year when fine weather set in. This fine dry weather which continued into January gave the grain crops a slight setback but most of them recovered with the showers which fell later. During February the rainfall was about normal but uneven distribution and short hot dry spells had a bad effect in some areas upon the late-planted millets, particularly sorghum. The March rainfall was the lowest recorded since the station opened in 1925 and by the end of the month most crops on the *mpala* land were drought-stricken. Early in January many dimbas had been flooded for a few days by a rise in the Shire and Ruo rivers and these areas did not suffer so badly from the otherwise general droughty conditions in March. During April weather conditions changed for the better and with a rainfall slightly above normal most crops recovered and succeeded in establishing themselves for the dry season which definitely began in the following month. Sweet potatoes and late crops of maize and beans were planted in April and germination everywhere was good. The early morning river mists began this month and continued until the end of August reaching their maximum intensity during May and June.

Absence of mid-season rains during the dry season had a serious effect upon the cotton crop. Slightly over 50 per cent. of the season's rainfall fell in November and December and of the remainder approximately 35 per cent. fell in January and February. By July any reserve soil moisture had been used and the whole of the Lower River had a very droughty appearance. It must be remembered that the district has, in common with the rest of Nyasaland, experienced a succession of dry seasons during the past few years and the cumulative effect of these is now being felt. A few light showers in June, July and August did no good at all and the season came to a rapid end with a rainless September and an almost rainless October. In 1931 the cotton bushes on the Ndindi marsh all died of drought in mid October. This year they were dying in mid August; by the end of August flowering all over the Lower River had ceased and by September the greater part of the crop had been uprooted.

Locusts.

A detailed account of the invasion of the Lower River by red-winged locusts (*Nomadacris septemfasciata* Serv.) will be found in the Entomologist's report.

Egg-laying commenced early in the year and increasing damage was done by hoppers from January up to end of February. Midway through March the attack began to die away and by the end of April young flying swarms were developing everywhere. Details of damage done are given under crop headings.

Cotton.

For the third consecutive year the Lower River produced a poor cotton crop. There was admittedly a slight increase over the previous year but this did not nearly justify the extra seed taken and the extra gardens planted. Late planting combined with a short rainy season was chiefly responsible for the low yield and only in a very few places was locust infestation a more

seriouss limiting factor than the failure to plant at the proper time. Cotton planted early in January gave good yields, and, speaking generally, the later the crop was planted the poorer it was. Very little that was planted after the middle of February on any type of land gave anything but a poor yield and March planting on the *mpala* land and April plantings on the dimbas gave no yield at all.

Seed stores were opened early in January at Chiromo, Port Herald, Ndamera, Nachikadza, Muona, Munga, Makwira, Maperera and Mwampanzi and were closed by the end of March. Seed was taken as eagerly as usual and issues were not so restricted as in the previous year nor were natives made to produce their hut-tax papers. 210 tons more seed were issued for an increase in crop production of 177½ tons of seed cotton. These figures show clearly the need for checking the seed waste that goes on. Production per lb. of seed issues was 6.6 as against a production of 14.5 in the preceding year. The whole of the Lower River was supplied with *U4* seed.

Early planting conditions were favourable and by the end of February gardens were showing good stands of healthy plants. During March conditions changed rapidly. Very poor rains and widespread damage by locust hoppers made the outlook by the end of the month very gloomy indeed. Reports from Chiromo stated that gardens in which plants had reached the flowering stage had been wiped out, and in this district at least it seemed doubtful whether there would be a crop at all. Through lack of rain cotton everywhere on the *mpala* land was making very little growth and germination in the late-planted gardens was very poor.

In April the Chiromo and Chikwawa areas were visited and it was found that native locust reports were, as usual, very much exaggerated. Even so, conditions were bad enough. During the month, however, most of the hoppers passed their final stage, and, as fliers became very much less troublesome and some useful rains relieved the drought, the end of the month found a much happier state of affairs than the beginning. With the April rains many more cotton gardens were planted. Germination was fair and for a time it looked as though the plants in these late gardens would establish themselves. A total rainfall of 1.26 inches for the whole of the next six months made this impossible. As will be seen from table no. 6 23 per cent. of cotton gardens were planted during April and after. It is safe to state that with very few exceptions the yields from these gardens were negligible.

By the end of April that part of the early-planted crop that had been badly attacked by hoppers earlier in the season was showing signs of recovery and a large number of gardens, particularly in the Chiromo area, recovered sufficiently to give good yields. Young plants that were attacked made no recovery at all.

Bollworm attack was comparatively light this year. During May bolls picked at random in various gardens throughout the district and examined disclosed the fact that about 30 per cent. contained bollworm larvae, in almost all cases red or Sudan bollworm (*Diaparopsis castanea*, Hamps.). Stainer (*Dysdercus* sp.) attack developed as the season advanced. During May nymphs were to be found in small numbers throughout the Lower River. By the end of August most gardens were infested with them and in certain areas the percentage of attack was high. The bulk of the crop, however, was in the markets by the end of September and therefore escaped serious damage. Late cotton suffered badly from the stainer attack.

The first cotton markets were opened on the last day of July and the remainder during August. Of the total crop 55 per cent. had been bought by the end of August and 98 per cent. by the end of September. For the first time for many years the British Cotton Growing Association were not the sole cotton buyers on the Lower River although they handled 89.3 per cent. of the crop. Captain R. E. Clegg, M.B.E. bought the remainder. Markets were opened by the British Cotton Growing Association at Port Herald, Chiromo, Munga, Makwira, Maperera, Kakoma, Mwampanzi, Muona, Ndamera and Nachikadza, and by Captain Clegg at Pimbi, Mitondo, Mfumu wa Mkazi, Munga, Masengere and on two private estates.

Opening prices were $\frac{7}{8}$d. per lb. for no. 1 grade at the Port Herald and Chiromo ginneries and $\frac{3}{4}$d. per lb. at the outside markets. These prices quickly dropped to $\frac{3}{4}$d. and $\frac{5}{8}$d. and then to $\frac{5}{8}$d. and $\frac{1}{2}$d., recovering again later in accordance with home market prices. The highest prices for no. 2 grade were $\frac{5}{8}$d. at Port Herald and Chiromo and outside stations; the lowest prices were $\frac{3}{8}$d. at the former and 5/16d. at the latter. Average prices paid by the British Cotton Growing Association were .66d. per lb. for no. 1, .40d. for no. 2 and .16d. for no. 3. Captain Clegg's prices were .625d. per lb. for no. 1 and .25d. per lb. for no. 2.

Under the Cotton Rules the uprooting date was again November 30. The number of offenders was 181. This figure represents .8 per cent. of the cotton growers and shows an increase of 61 per cent. over the preceding season.

Data in connection with the season's crop will be found in tables 4a to 7 at the end of this report. Figures of district and area yields and seed issues are of little value for purposes of comparison with former years and for this reason have been omitted. Once market and seed store sites are permanently established, as they will be under the new Cotton Ordinance, these figures will be of more interest but will never be of much use as natives will not necessarily take their seed from the same store or their seed cotton to the same market every year, particularly when they live in places equidistant from two. Figures of seed issues and yields are given for the Lower River, i.e., Port Herald and Chikwawa districts combined.

Seed was issued from nine stores and seed cotton bought at seventeen markets. Apart from extra transport costs which the cotton industry can ill afford, it is doubtful whether it is wise to pander to native laziness to this extent. If a native grower is too lazy to travel twenty five miles for his seed or to take his seed cotton twenty miles to market he is too lazy to grow cotton at all

The policy of making things as easy as possible for him is a mistaken one and leads him nowhere. Dumping seed all over the country and giving the native unrestricted access to it will undoubtedly lead to a large temporary increase of crop but it will be found that production figures remain low, that the total crop varies considerably and drops heavily after a year of low prices, that gardens are badly cultivated and uprooting offenders many and that the whole industry is built on very insecure foundations. With regard to markets five only were needed this season at Port Herald, Chiromo, Munga, Maperera and Makwira but it would be advisable to keep open the market at Kakoma if the northern end of the Chikwawa district is to grow cotton again. This market takes the place of the two former markets of Tombondera and Nkadana and its establishment would give some confidence and encouragement to the growers in the north.

The danger of late planting was more evident last season than ever and was stressed by the hopper attack in March. Cotton that had been planted before mid-February and was well established when attacked recovered, even when eaten back to the ground, and bore a crop. Young late-planted cotton invariably succumbed and in uninfested areas died from drought on both *mpala* and *dimba* land. The native must not be encouraged to pander to the flood bogey year after year. In the years when there is no flood the majority of the cotton dimbas dry out by June and cotton planted in March and April stands a poor chance of giving even a fair crop. In a bad flood year it will certainly be necessary to plant a second time, but after a flood the dimbas do not dry out quickly and late-planted cotton does well. Under no circumstances should late planting be advised. In some years it is unaviodable, and in such years circumstances are such that as a rule the late-planted crop does well. The result of late planting in these years, exceptional years be it noted, should never be held up as an example to be followed in all years.

Continuing the practice of former years, a cotton garden census was carried out by the native agricultural instructors. Records of weights of seed cotton bought from the owners of certain measured gardens were kept by the buyers for the British Cotton Growing Association, Messrs. G. M. Boby, F. Stephens and J. M. Thorburn, and to them for their help and to the association for its courtesy in placing all available data at his disposal, the writer wishes to record his thanks. In the following paragraph a few comments are made on the facts disclosed by the tables.

From the measured native cotton gardens (table 7) and from the garden census it was found that, although the size of the average garden had increased slightly from 1931 (from 1.36 acres to 1.42 acres), the larger growers had reduced their acreages considerably and in 1933 there were few gardens of over 3 acres. The average size of the garden is smallest in the Port Herald area and largest in the Chiromo area; this has been the case also in former years. The heaviest yields came from *dimba* gardens either in the Munga or Ndindi marsh areas; the average yield per garden was the lowest recorded during the past four seasons and the difference between the figures given in table 7 and table 6 may be explained by the fact that in the former case the weights were recorded from certain gardens that had survived drought and locust attack whereas in table 6 the figure includes the 23 per cent. of late-planted gardens that gave no crop at all and were in many cases abandoned. The large proportion (17.8 per cent.) of women cotton planters will be noted; the number increased tremendously last year. The total number of gardens exceeded that of the 1930-31 season and was almost double that of 1931-32; it was still some 3,000 short of the 1929-30 season. In the Port Herald area the number was higher than it has ever been. This increase was due to the ease with which seed was obtained from any of the three stores in this very small area. Hundreds of natives took seed from the Nachikadza and Ndamera stores, planted gardens late and neglected them, who would never have taken seed had they had to walk to Port Herald for it. The dangers attendant on late planting have already been mentioned. The figures show that 23 per cent. of the gardens were planted after March. Over the whole Lower River a slightly larger acreage of cotton was to be found on the *dimba* land (heavy alluvium liable to be flooded or to be indirectly affected by a flood through the immediate rise of its water table) although the division between the two types was fairly equal. The difference between the two districts may be explained by the fact that in Chikwawa maize, the most important food crop of the district, competes with cotton for room on the dimbas whereas in the Lower Shire district millets, an *mpala* land crop, take the place of maize in the native dietary leaving the dimbas free for cotton and a small maize crop. The increase in seed issued kept pace with the increase in the number of gardens. In spite of the unrestricted issue of seed the average issue per garden and the average issue per grower was very little higher than that of the previous year.

Native Food Crops.

General.—Full advantage was taken of good early planting rains in November, and well distributed growing rains in December, January and February ensured excellent grain crops in most areas. The short dry spell at the end of December and beginning of January did little harm to any of the grains with the exception of rice. Had it not been for the locust attack, which developed early in February and reached its height in March, the Lower River would have experienced one of the finest harvests it has had for some years. It was partly due to the heavy grain yields obtained in adjoining districts that the inhabitants of infested areas were able to live through the season with so few signs of any real hardship or food shortage. Another contributory factor to this escape from famine, which at one time appeared imminent in at least two areas, was the large acreage of sweet potatoes that the natives planted early in April and which, considering the poor mid-season rains, yielded well.

Of the two most important grain crops, maize and sorghum, the former gave the better results in spite of a slight set-back during December when many gardens were slightly water-logged through excessive rain. In places locust hopper attack on both was severe, but over the whole Lower River the sorghum crop suffered far more than maize. Not only was it more badly attacked over a large area by hoppers but in uninfested areas it was badly damaged by seed-eating birds. The *machewere* (*Pennisetum spicatum*) crop was good everywhere, in many areas excellent, and was harvested before the main locust attack had developed. A few late gardens in the Chiromo area were completely destroyed. Minor food crops such as groundnuts, pulses, rice and finger millet (*Eleusine coracana*) suffered to a varying extent but the total damage was slight.

An attempt has been made to assess the extent of locust damage on the Lower River in actual figures. At Chiromo it is estimated that 75 per cent. of the sorghum crop was lost, approximately 2,700 tons of grain. Damage to other millets and maize was slight and in all did not exceed 10 per cent. of the normal yield; this loss in weight of grain is estimated at 550 tons. In Chikwawa district the maize crop suffered in one section and to some extent in many others. The total damage accounted for a reduction in yield of some 3,000 tons of grain, representing 30 per cent. of the crop. In the Port Herald area the total food-crop destruction by locusts did not exceed 3 to 4 per cent. It is estimated that locust damage over the whole Lower River reduced the total grain yields by about 15 per cent. The greater part of the damage to crops was done by hoppers. Once the flying stage was reached in April, the situation improved rapidly, natives finding that they could keep their gardens free from the flying swarms with comparatively little trouble. Good April rains encouraged *dimba* planting and the exceptionally large sweet potato crop, to which reference has already been made, was planted this month.

Speaking generally, it must be admitted that the Lower River native worked hard and well at his garden this season under the most depressing and heart-breaking conditions. Most natives did their very best to provide themselves with food of some sort when their grain crops were taken. During March many new *dimba* areas were opened up and with April rains large gardens of sweet potatoes, late maize and pulses were planted. In the Chiromo area natives went to the Cholo hills and worked in native gardens there for food. Fish from the river, grass seed from the bush, cassava roots from the hills and wonderfully cheap grain in the native markets were all contributory causes to the very calm way in which natives in the worst areas faced their unpleasant situation. Towards the end of the year grain certainly became scarcer in the native markets and, of course, dearer. Even so, it was always obtainable. The yearly waste of grain for brewing purposes occurred as usual. It had more serious consequences this year owing to the shortage in many areas but even famine does not stop the native from using the last of his grain for beer.

Machewere (*Pennisetum spicatum*).—The main crop planted with the early rains in November and harvested during February gave a heavy yield. Where planting was delayed, the gardens, in the Chiromo area particularly, were invaded by locust hoppers and the crop destroyed. The average yield for the Lower River was about 800 to 1,000 lb. of grain per acre: many of the best gardens must have given 1,200 lb. or more. *Tolyposporium penicillariae* and *Sclerospora graminicola* caused a certain amount of loss in yield but appeared to be controlled to some extent by earlier planting. Over two tons of selected seed from the station were exchanged with natives for their own seed.

Observation plots of mixed cotton and *machewere* were repeated for the third successive year. The observations made confirmed those of the previous years, that for success cotton should be interplanted as early as possible in January, just before the *machewere* begins to shoot, i.e. about five to seven weeks after planting. As was pointed out last year, the millet crop suppresses the lower laterals of the cotton plants so that, even in the wettest years, there is little fear of any jungly growth through early planting. The advantages of this intercropping system are that the ground remains covered from the beginning of the rains until the end of the dry season and that the area under native cotton can be considerably extended. On the experimental station the crops have always been sown in alternate rows, but it is probable that better results would be obtained from the native method of scatter planting the *machewere* at three ft. intervals and then interplanting the cotton between the clumps. Many natives interplanted the crops in this way for some years but the system is not so widespread as it should be, and some doubt exists in the native mind, judging by the varied planting dates, as to the best time at which to interplant.

Another observation trial which has been repeated for the third successive year is the comparison between the native method of planting and line planting. The usual native garden is planted with a mixture of *mapira* (*Sorghum vulgare*) and *machewere*, the seed being mixed before planting and sown in scattered holes roughly three ft. apart. When the plants are some nine inches to one ft. high, gaps are filled with plants taken from the thickest clumps but otherwise no thinning is done. On the station this method has been tried against a plot of the same size planted with *machewere* and *mapira* in alternate three ft. lines which were thinned later to 18 inches between the plants. In the two previous years the *mapira* in both plots gave approximately the same yield. In the third year it was destroyed by locust hoppers. In all three years the *machewere* in the plot sown in the native way has given twice the yield of grain given by the other plot. In the first year in the plot sown in lines the alternate rows were two ft. apart and were thinned to six inches in the case of *machewere* and one ft. in the case of *mapira*. The effect of crowding *machewere* is definitely beneficial to the yield and in each year the crop on the native plots has ripened at least two weeks earlier than that on the other.

Mapira (*Sorghum vulgare*).—Where the crop was not totally destroyed by hoppers, as in the greater part of the Chiromo area and some parts of Chikwawa and Port Herald, the yield was appreciably decreased by the attacks of seed-eating birds. The unusual damage caused by the latter was the direct result of earlier locust infestation in the districts where the crop was destroyed, resulting in a heavy concentration in the areas where there was still grain to be had.

As with *machewere*, the main crop was planted with the early rains in November with some later plantings in December. Germination in all cases was good but the late-planted gardens suffered a little from the dry spell in December and January. By the end of February the plants had grown well, and, but for the locust attack which by the end of March had entirely destroyed the crop in the badly infested areas, would have given a heavy yield. In spite of the bird attack, gardens in some areas gave excellent yields, but the average for the Lower River must have been very low indeed, probably in the neighbourhood of some 250 to 500 lb. per acre.

Witchweed (*Striga asiatica* O.Kuntze and *Striga aspersa* Benth.) was much less prevalent than last year. Many areas were entirely free and in none of the areas visited was it very common. Natives were again advised to hand-pull the weed before it flowered and a large number did so. It is difficult to say whether the two main pests of *mapira*, the stem-borer (*Chilo* sp.) and the smut (*Sphacelotheca sorghi*) were bad or not this season. They were certainly completely overshadowed by the locust attack and even in uninfested areas appeared to be much less in evidence than last year. As was described in last year's report, the results of the field experimental trial in 1932 on seed treatment against *Sphacelotheca sorghi* were completely nullified by stem-borer damage and this year a combined manurial and time-of-planting trial with untreated seed was laid out and planted to see what effect such treatment would have on the insect and fungous attack. The hoppers unfortunately attacked this field with the others and no results were obtained. The layout was in the form of Fisher's randomised blocks with six replications and the six treatments under trial were as follows:—

Plot	Treatment	
A ...	5 tons compost per acre	Planted 25-11-33.
B ...	10 ,, ,, ,, ,,	
C ...	No compost—control	
D ...	5 tons compost per acre	Planted 21-12-33.
E ...	10 ,, ,, ,, ,,	
F ...	No compost	

The *mapira* spacing trial was repeated but locusts destroyed the plants and no results were obtained. The layout and number of replications were the same as for the manurial and time-of-planting trial and the six treatments are given below.

Plot	No. of rows	Inter-row space ins.	Between plants ins.	No. of plants per hole	Theoretical no. of plants per acre
A ...	15 ...	36 ...	12 ...	1 ...	14,520
B ...	15 ...	36 ...	24 ...	2 ...	,,
C ...	10 ...	54 ...	12 ...	1 ...	9,680
D ...	10 ...	54 ...	24 ...	2 ...	,,
E ...	8 ...	72 ...	12 ...	1 ...	7,260
F ...	8 ...	72 ...	24 ...	2 ...	,,

D = control plots with 9,680 plants per acre, the approximate native garden density.

A certain amount of ratooning is still carried out in native gardens, but continual propaganda during the past two years has had some effect and the practice is far less common than it was at one time. At the end of the sorghum season this year the stalks were quickly and very thoroughly destroyed. This laudable promptness was undoubtedly due to the desire to plant early with the first November rains, a desire that was the outcome of the locust attack and that will go when the locusts have gone. It has been evident during the past few years that borer attack is far worse on the station at Port Herald than in surrounding native gardens. Captain Smee pointed out to the writer that this may be accounted for by the fact that for some time now pure stands of different varieties of sorghum have been grown on the station whereas in the native garden some twenty varieties are all grown together. If the stem-borer has any selective faculties the plots of pure stands must offer him a very much more attractive dish than the native garden of several sorghum varieties mixed with *machewere*. This problem is an old one but none the less important for that; it applies to many crops other than sorghum. From many points of view the pure stand may prove to be a very mixed blessing to the native cultivator.

The writer is working on the different Lower River varieties of *mapira*. From observations already made it is obvious that the varieties do not cross readily under natural conditions due to the fact that in Nyasaland the anthers dehisce just before emergence, the pollen being liberated long before sunrise and apparently reaching the stigmas, which are exserted simultaneously with the anthers, before they emerge.

Maize.—Where the crop escaped locust attack, as it did over practically the whole of the Lower River with the exception of two large areas, the yield of the first and main crop was good. Planted in early November, with the first rains, it suffered a little from excessive rain in December and yellowed slightly but recovered in January and by February had formed green cobs. In the two badly stricken areas already mentioned, P. H. Kasisi's district and the area round Chiromo, a certain number of green cobs was gathered, but a large proportion of the grain was lost before it ripened. In the rest of the district harvesting was over by the end of March. It is difficult to estimate the yield at all accurately. The average garden probably gave some 1,000 lb. of shelled grain at the first cropping and about half of this amount at the second. Some certainly gave very much more but the failure in the bad areas lowered the average considerably. Some gardens were planted three times in the year and gave three crops. None of the crop was lost from flood this year.

No experimental work on maize was carried out in 1933 at either the main (*mpala*) station or the *dimba* sub-station. The soil of the former is too light and sandy to carry a maize crop except in unusually wet years, and the interplanting trials on the *dimba* sub-station were visited by locusts and entirely destroyed. Spacing and interplanting trials have been included in next season's cropping scheme.

In spite of the widespread infestation of sorghum and *maere* (*Eleusine coracana*) with witchweed, maize is seldom if ever parasitised. No reports of its occurrence in *dimba* maize gardens have ever been received nor has the writer seen it although it has been reported from the Chikwawa district. *Epicauta velata* Gerst. (a Meloidae beetle) was found in large numbers in one garden on the Ndindi marsh during April doing great damage to the crop by eating the young male flowers and the tassels and tips of the young cobs.

During practically every month of the year maize is being planted or harvested somewhere or other on the Lower River. The main crop is planted with the first rains and harvested in late February or early March. The second crop is planted in late March or early April and is harvested in June. With good mid-season rains a third crop can be obtained and sometimes is. A great deal of the second crop is interplanted with beans (*Vigna* and *Phaseolus* spp.), marrows and pumpkins. The main crop is usually a more or less pure stand although it is not an uncommon practice to interplant a few beans and pumpkins. A certain amount of mixed cotton and maize is grown and the acreage might well be increased. The best time for interplanting the cotton appears to be when the first maize crop is ripening late in January or early in February. Sufficient but not excessive shade is given to the young plants and just after they are established the maize is harvested, the plants receiving a good cleaning when the maize stover is removed. As a general rule the native interplants his second maize crop with cotton, when he adopts this mixed cropping system. The cotton is planted in mid April, when the maize is about two ft. high, and by the time it is flowering is under heavy shade. Cotton will not stand excessive shade, as has been found on the station in the interplanting trials, and the planting date, even for *dimba* land, is too late.

Maere (*Eleusine coracana*).—The main finger millet crop was ripening by the end of April and was harvested in May. A large area was planted this year, and where it survived locust attack the yield was heavy. Several gardens were badly parasitised by witchweed, but on the whole the infestation was not so heavy as in former years. Seed beds are as a rule planted in December or early January and young seedlings planted out in February or early March. This grain could be a useful standby in years of shortage because of its excellent keeping qualities. Its chief use unfortunately is in the manufacture of beer, and in consequence by the time the other grains are finished *maere* has also been finished.

Rice.—The main crop, planted with the early rains in November, was in head by the beginning of March. Some of the earliest gardens, in which the seed had been planted dry in October, were harvested by the end of March but the main crop was not ready until May. Generally speaking, the yields were good except in the Ndindi marsh where the greater part of the Lower River rice crop is grown. Here poor rains and the early drying out of the heavy black marsh soil combined with one or two visitations from flying swarms of locusts resulted in complete failure of many gardens and the partial failure of the most. Fortunately, rice forms a very minor and unimportant part of the Lower River native's dietary and is grown solely for sale to Indian traders whose food it is. Such a market is of course purely local and demand is very limited. Unless rice becomes a part of the native dietary or can be profitably exported, it will be unwise to encourage natives to increase their rice area on the Lower River. Some of the varieties grown are of excellent quality and yield well; most of them are comparatively pale-skinned. Trial observation plots will be established on the Port Herald *dimba* sub-station next season and seed of the following local varieties has been collectod for planting there. Unfortunately only small amounts of pure seed could be obtained owing to the very poor yields and the fact that the native does not often sow pure seedings. In this respect he may be wise, as pointed out in the notes on *mapira*, although the crop does not at present appear to suffer much from any pest in the field.

LONG-TERM VARIETIES.

1. *Tyolakhosi* ... Large bold white grain. Husk striated; often with purple lines.
2. *Singano* ... Smallish white broad grain.

SHORT-TERM VARIETIES.

3. *Mpunga mkhundi* Large bold red grain. Husk dull yellow.
4. *Indian* ... Small white broad grain.
5. *Namichila* ... Long narrow white grain. Red awned husk.
6. *Nkuta* ... Exactly similar to *mpunga nkhundi*. Probably synonym.
7. *Rega* ... Very similar to *namichila* but smaller. White grain.
8. *Ngungunda* ... Large broad red grain. Husk awned.
9. *Bungala* ... A mixed sample obtained. There appears to be a sub-variety which is long-termed. The grain is white and this variety with its sub-variety appears to be popular with the rice-growers because of its hardness and yield.

Fifteen rice gardens were measured during the season so that some idea of the average yi of different varieties might be obtained. The average garden is small and from measurements was found to be only .19 acres. From general observation this would appear to be slightly on the small size but the average size certainly does not exceed .25 acre. From six of the measured gardens no results were obtained, three being eaten down by locusts and three failing through drought. Most of the gardens were visted by locusts at one time or another and, as can be seen, some suffered very badly. All were more or less affected by the very dry conditions on the Ndindi marsh.

Rice variety		Acreage	Yield per acre
1.	*Bungala* ...	.46	8 lb. in head
2.	Mixed *bungala* and *mpunga nkhundi*	.13	1,350 „ „ „
3.	*Tyolakhosi* ...	.57	10 „ paddy
4.	„ ...	.12	166 „ in head
5.	*Indian* ...	.10	20 „ paddy
6.	*Singano* ...	.22	107 „ „
7.	*Nkuta* ...	.16	375 „ „
8	„ ...	.07	300 „ in head
9.	*Namichila* ...	.08	31 „ paddy
	Two other gardens, not native grown, near Chiromo.		
10.	*Indian* ...	1.11	3,600 lb. paddy
11.	*Namichila* ...	.66	2,848 „ „

Sweet Potatoes.—The main crop was planted in the dimbas during April. The comparative immunity of the plants to locust attack saved the Lower River from a very bad food shortage and possibly a famine. Harvesting commenced in August and heavy yields of well-formed tubers were obtained.

Pulses.—On the *mpala* land most of the pulses (*Phaseolus* and *Vigna* spp.) where they escaped locust damage yielded well. *Phaseolus mungo*, green gram, gave a heavy crop which ripened and was harvested bofore the hopper attack developed and most of the light land beans, except in the worst areas, were sufficiently far advanced to be harvested before they suffered much.

With the April rains large areas of *dimba* maize gardens were interplanted with beans, principally *Vigna* and *Phaseolus* spp. (*nseula*, *mulasa* and *chimbamba*). Germination was good and the yields were excellent. *Chimbamba* beans, (*Phaseolus vulgaris)* were also planted on the hills during April and here too the crop gave a heavy yield.

Nandolo (pigeon pea, *Cajanus indicus*) is slowly increasing in popularity on the *dimba* land and heavier *mpala* land. It is still mainly planted as a boundary line between gardens but occasional stands are now seen south of Port Herald, and in the Chikwawa district, where the crop has always been more popular, the acreage has certainly been extended in the past year or two.

Groundnuts.—A smaller acreage than last year planted in December gave a fair yield. In the Lower Shire district a trial export consignment of 10 tons was obtained by the African Lakes Corporation with some difficulty. At first the native grower was given 1d per 3 lb. but the price had to be raised to 2 lb. per 1d before the nuts could be bought, and even so it took three months to complete the consignment, the last half ton being bought from an Indian trader in Port Herald. Local demand in Nyasaland for groundnuts for soap and oil manufacture has given the native grower a very exalted idea of the value of his crop. If groundnuts are to become an economic crop, the grower must be willing to accept a much lower price for his produce. At 1d per 4 lb. a well-cultivated garden will be a profitable proposition for the grower, but trading in the crop by Indians must be stopped and, as in the case of cotton, the cash price must be paid direct to the native grower at recognised markets.

Other Crops.—Simsim (*Sesamum indicum)* was grown nearly everywhere on the Lower River but always in very small patches, generally on the ash-heap outside the hut. Goats and sheep never touch the foliage and to locusts, both hoppers and fliers, it appeared to be equally distasteful. There is always a small local demand from Indian traders who express the oil for cooking purposes. The crop usually does well under Lower River conditions.

A certain amount of cassava was planted but, as in the case of pigeon pea, mostly in single lines along the edges of gardens. Most of the Lower River cassava comes from the hills where it is planted in April. The crop is then ready for harvest in September (6 months) but is generally left until the June or July of the following year (16 months), when the roots are much bigger. A number of natives who do not usually plant this crop gave it a trial last year and cuttings from the Malayan cassava grown on the main *mpala* station were given to several natives. For some time it was thought that cassava was immune to locust damage but this was ultimately proved to be incorrect.

A few small patches of *Koti Koti* (Siberian millet, *Setaria italica*) were grown in the district and harvested in March. Black gram was grown in some gardens and found a ready sale with the Indian traders. A few natives grew sunflowers and expressed a crude cooking oil for their own use.

Native Agriculture in General.

During the year the greater part of the Lower Shire and the south end of the Chikwawa districts were visited. The north end of Chikwawa was rather neglected but late in the year a ulendo was made through the Ngabu section with the object of gaining an idea of the food situation there and of ascertaining the agricultural possibilities of the area in which wells had been sunk. Short talks were given to various headmen and natives in their villages and native instructors were entrusted with propaganda work and delivery of special advice at certain seasons.

A close study of native methods on the Lower River has shown that the native practice of growing millets, cotton and legumes in the same garden is a sound one when the time at his disposal for agricultural work, his way of living and his fear of hunger are taken into consideration. The mixtures, the seed and the methods are undoubtedly capable of improvement but the fundamental idea of mixed cropping is sound. Various trials of mixed cropping have shown that not enough is known of the correct times of planting and much work requires to be done on these lines. Observation plots have shown that grains, legumes and cotton can be profitably grown together in certain mixtures but not in others. From the point of view of soil conservation some very useful crop mixtures have been tried and found satisfactory. The possibilities of cotton as a catch crop after maize and rice require further investigation.

Mention of the native tendency to increase the pigeon pea acreage has been made. Another observation made this season was that the *machewere* and maize areas seem to have been extended at the expense of *mapira*. The gardens just planted (November and December 1933) bear this out. *Mapira*, as has been seen, suffered more than any crop from locust attack and it may be that the change is merely temporary. More *dimba* land has been put under cultivation this year than in former years; it remains to be seen whether the acreage will shrink when the locust menace disappears.

It is becoming increasingly evident that certain areas of the Lower River are not particularly suited to cotton production and that no heavy yields can ever be expected from the light-land (*mpala*) gardens; only after a series of exceptionally wet seasons will this land give even a fair cotton crop and just now, after the past dry cycle, the yields are negligible. This past season the unsuitability of the lighter *mpala* land for cotton was more marked than ever. Groundnuts are a very desirable substitute for cotton on this type of land where it borders the hills but the native cultivator is not likely to make the change a permanent one unless the new crop provides him with the same amount of money for work done as the old. Demonstration of relative values and of new seed and varieties should and will be carried out under native conditions. Until an economic substitute can be found for cotton, and after, much work remains to be done in the district in the native garden under native conditions.

Simsim is a possible cash crop of the future and there is no reason why it should compete unduly with either cotton or groundnuts. Of all the Lower River crops *mapira* is the most unhappy and gives on an average the poorest return for time and labour spent. Apart from locusts, the fungous diseases, *Sphacelotheca sorghi* particularly, insect pests, of which the stem borer *Chilo* sp. is the most important, and the parasitic witchweed, *Striga* spp., all take a heavy yearly toll of the crop. Not only is the yield generally poor but the sorghum plant itself is a gross feeder and has a more deleterious effect upon general soil fertility than practically any other crop; this is not peculiar to the Lower River, nor to Nyasaland, for it has been long established all over the world wherever the crop is cultivated to any extent.

Should groundnuts and simsim ever become profitable native cash-crops in Nyasaland, the writer would not be surprised to see the Lower River native cutting down his food-crop acreage considerably, planting larger gardens of cotton, simsim and groundnuts and buying a part at least of his grain from other districts. In the 1929-30 season there was a distinct tendency to increase the cotton acreage at the expense of the food crop but the drop in prices in 1930 quickly put an end to this.

A few more natives have displayed a genuine interest in the station this year but speaking generally the work there does not interest them. A certain amount of selected *machewere* seed was given out and some Honduras maize, Malayan cassava, Spanish Bunch groundnuts and selected *mapira*. The small observation plot out in the district, preferably a native garden and cultivated with the native hoe, is likely to be the best form of attack for some years to come. Statistical work must of course be confined to the station; in any case minute replicated randomised plots are too bewildering to the native eye to convey anything to him other than an idea of complete confusion.

Pineapple Plots.—Details of these plots on the Malawe plateau, Port Herald, were given in the Annual Report for 1931. The plants fruited while the writer was on leave and unfortunately no records were kept. From counts made during visits after return from leave it appears that native information regarding yields was probably correct; the native watchman in charge stated that Plot No. 2 gave by far the highest number of fruits but that they were smaller than those from other plots. Counts made in November this year of the numbers of young fruit per row and per plot give the following figures:

Plot 1. 7 triple rows ... 1, 7, 7, 8, 11, 11, 10, total of 55 fruit; 7.86 fruit per triple row. Plants healthy.

Plot 2. 9 double rows ... 11, 15, 14, 11, 10, 11, 8, 8, 2, total of 90 fruit; 10 fruit per double row. Plants healthy. Fruit smaller and later than in Plot 1.

Plot 3. 14 single rows ... (wide-spaced)
3, 1, 0, 1, 1, 5, 5, 4, 7, 2, 3, 5, 5, 4, total of 46 fruit.
3. 3 fruit per row.
As for Plot 2. Fruit small and late.

Plot 4. 18 single rows ... (close-spaced)
2, 3, 1, 1, 0, 1, 0, 0, 1, 1, 2, 1, 1, 1, 0, 0, 0, 0, total of 15 fruit.
0.83 fruit per row.
Plants and fruit small. Some buds diseased and fallen.

The figures have of course no statistical significance but the results are interesting and point to the fact that further investigation with regard to spacing is required. The native in charge had been ordered by the District Commissioner to remove all suckers as they appeared so that it was impossible to form an idea of the influence of spacing on suckering. The terraces stood up well to the rains.

Propaganda and Advisory Work.—Apart from special ulendos in connection with anti-erosion measures, agricultural surveys of well sites, etc., journeys were made at various tines by the writer and regularly by the native instructors to principal headmen and others to advise them on various points. Propaganda work on the suppression of ratooned *mapira*, the eradication of *Striga*, seed selection, better cotton grading, clearing gardens after the rainy season was over and on numerous other subjects was continued through the year. The results in many cases were nil but a little improvement can be seen in one or two directions, Quite a number of natives definitely tackled their witchweed problem, hand-pulling the weed before it flowered, and the number of ratooned *mapira* plants should be even fewer next season than they were this. A few small-holders come regularly to the station for seed and help and it is hoped that the number will gradually increase.

The less said about ploughing in native gardens and communal grain stores the better. The former was stopped by another outbreak of trypanosomiasis early in May in which two bullocks were lost before the first course of injections took effect; this with the extra ploughing required on the *dimba* sub-station left no time for outside ploughing. With regard to the grain stores, locust damage to the *mapira* crop was so severe that in many cases natives had only enough grain for a month or two, and none to spare to put in the stores. While camping in the Makoko's village the writer had a long talk to the headman about the stores. Were all the Lower River headmen like Makoko every village would have its grain store within the next few years. Unfortunately they are not.

Native Agricultural Instructors.

For some time to come the instructors' most useful work will be that of recording general and special agricultural news of the Lower River. Until they have had some training they cannot teach, and care has been taken to see that in the way of giving advice to natives they only repeat definite instructions.

During the first three months of the year they were as usual engaged on cotton work, helping with seed issuing and carrying out propaganda work on early planting and intercultivation. They were at the same time necessarily employed on locust work and in urging natives to harvest *machewere* and early maize and to work on *dimba* gardens in readiness for planting with the first April rains.

During May, June and part of July the usual cotton garden census was carried out and on completion the instructors were engaged on cotton and groundnut propaganda work. The native cultivator is rather apt to delay too long in picking his cotton. He prefers to wait, quite understandably, until he can pick several basketsful at one fell swoop; unfortunately the earliest opened cotton very often suffers during the waiting period, being eaten by field mice and *gologolo.* or beaten down to the ground by rain. For this reason the instructors have standing orders to warn all natives to commence picking their cotton directly it is ready.

At the end of August the cotton markets opened and during the month word was sent out to growers as to time of opening and the price to be paid; further advice as to picking and grading was given.

During October locust swarms began concentrating along the foothills and until the end of the year the instructors were engaged for the greater part of their time on locust work. Propaganda work was also carried out on simsim and groundnut export and the general feeling of native growers towards these crops was carefully sounded

The farm diaries have been continued and are becoming valuable sources of information. The instructors are gradually learning to keep out extraneous matter and to keep to the point. One or two are still rather verbose and apt to write an essay where a few words would suffice.

As a result of unsatisfacotry work and conduct two of the three Chikwawa instructors were discharged at the end of May. Two more were engaged one of whom was discharged at the end of June for absenting himself from work without permission. A third native was engaged in July and proved to be satisfactory. It was decided that the old system of having the Chikwawa instructors paid by the District Commissioner was not very satisfactory and a new arrangement was made whereby the District Agricultural Officer became directly responsible for their pay. It is probable that a little more weeding out will have to be done but speaking generally the present nine are about as good of their kind as can be had at the present rate of pay. Considering their lack of training, poor pay and poor housing they do a wonderfully good job of work.

The Experimental Station.

The 1932-33 main (*mpala*) station cropping was as follows:—

Three 2-course rotations.

1. Silage crops (sorghum and maize); and cotton.
2. *Pennisetum spicatum* (*machewere*), followed by a catch crop of pulses; and sorghum
3. Sorghum and cotton.

Three 3-course rotations.

1. Pulses (soya and Tepary beans); sorghum; and cotton.
2. Cotton; groundnuts; and millets (sorghum and *machewere*).
3. Various native millets, sweet potatoes and simsim; *machewere*, followed by a catch crop of pulses; and cotton.

One 4-course rotation.

Millets (*machewere* and sorghum); cotton pulse-oilseed (half pigeon pea and half groundnuts); and cotton.

Three fields of mixed cropping.

Two of these fields form a 2-course rotation with each other; the third will be kept under the same crops year after year.

Under the above system the acreages under the different crops in any year will be:

Cotton	19.50 acres
Groundnuts	3.75 ,,
Pennisetum spicatum	6.50 ,,
Sorghum vnlgare	9.00 ,,
Pulses and oilseeds	8.25 ,,
Various small millets, sweet potatoes, etc.	7.00 ,,
Silage crops (sorghum and maize)	1.00 ,,

There is not the space available in this report to record the yields of all the different crops with the field notes made. They are on record in the district agricultural register in the office at Port Herald with plans of the different fields and experiments. The writer has also extracted and put in the form of a plan the cropping systems under which the station has been run since 1926, the first year in which the original 30 acres came under cultivation. Brief notes on this season's cropping are given below.

Very poor yields were obtained from most of the crops grown on the station. Hoppers in March destroyed the sorghum crop entirely and seriously reduced the yield of *nachacha* (*Pennisetum echinurus*). In the case of the former most of the stalks were ensiled. Cottcn was affected to some extent but the fields that were planted early in the season, in late December and January, recovered; cotton that was planted late, particularly in the time-of-planting trials, succumbed to hopper attack but would have died in any case under the dry conditions that set in during May. *Machewere* (*Pennisetum spicatum*) and groundnuts yielded well but the pulses without exception suffered from the long dry season and lack of mid-season rains; they were all planted rather later than in normal years as all labour during March was engaged in trying to save the mapira (*Sorghum vulgare*) from the hopper attack. Cotton, in spite of locusts and poor season, gave a very slightly higher average yield per acre than last season. The figures this season were 199 lb. per acre of no. 1 grade seed cotton as against 190 lb. last season and 64 lb. per acre of no. 2 grade as against 52.4 lb. last season; the percentage of no. 1 grade to no. 2 was 78 in 1932, this season it was 75. The highest yield on the station was 549 lb. of seed cotton (both grades together) per acre from a $2\frac{1}{2}$-acre bulk. Another $2\frac{1}{2}$-acre field gave over 500 lb. per acre. The highest yield last year was 567 lb. per acre, also from a $2\frac{1}{2}$-acre bulk.

During April the silage pit was filled, closed and mudded in. Its cubic contents are 1,700 cubic feet; the total weights of chopped green fodder put in were:

	Green weight	
Maize (from $\frac{1}{2}$ acre grown for silage)	6,474 lb.	(2.89 tons)
Beans (,, ,, between maize)	860 ,,	(0.38 ,,)
Sorghum (from $\frac{1}{2}$ acre grown for silage)	19,468 ,,	(8.69 ,,)
Sorghum (from $1\frac{7}{8}$ acres damaged by locusts)	40,673 ,,	(17.71 ,,)
Pennisetum purpureum (*nsenjere grass*)	2,400 ,,	(1.07 ,,)
	69,875	(31.20 ,,)

The pit was opened during November and all cattle at work were given a ration of 15 lb. each per day. There was no waste, the cattle eating sides and top readily.

Interplanting trials have been continued this season and some of the observations made have been already noted under the crop headings. The following crop mixtures have been under observation in half-acre plots.

	Between rows	Spacing in rows
1. *Pennisetum spicatum* (*machewere*) and cotton	2 ft.	millet 12 inches, cotton 2 ft.
2. *Sorghum vulgare* (*mapira*) and cotton	2 ft.	millet 18 inches, cotton 2 ft.
3. *Sorghum vulgare* and soya beans	2 ft.	millet 18 inches, beans 12 inches
4. *Sorghum vulgare* and groundnuts	2 ft.	millet 18 inches, groundnuts 12 inches
5. *Sorghum vulgare*	Black gram in 2 rows between 4 ft. millet rows. Millet and black gram 18 inches.	
6. Cotton and groundnuts	2 ft.	cotton 2 ft., groundnuts 12 inches
7. Cotton and pigeon pea	2 ft.	cotton 2 ft., pigeon pea 6 inches
8. Cotton and lima beans	2 ft.	cotton 2 ft., lima beans 12 inches
9. Pigeon pea and *Pennisetum* sp. (seed from India)	3 ft.,	both 18 inches
10. Pigeon pea and *Sorghum vulgare*	3 ft.,	both 18 inches
11. *Mapira* and *machewere*	Seed mixed before sowing, native fashion, holes scattered, approximately 3 ft. apart	
12. *Mapira* and *machewere*	planted in alternate rows 3 ft. apart with 18 inches between plants.	

Comment has been made already on the mixed *mapira* and *machewere* plots (nos. 11 and 12.) and on the *machewere* and cotton plot (no. 1). In every plot locusts did a certain amount of damage and only very general observations have been made.

Mixed cropping with *mapira* requires more investigation. Cotton and *mapira* do not appear to do well together ; the sorghum overshadows and smothers out the cotton so badly that even after harvest the cotton does not recover. With the other crops of soya beans, groundnuts and black gram (plots nos. 3, 4 and 5), the yields from all three were poor and it is believed that in all cases they were planted too long after the sorghum. Trial should be made of planting the grains and pulses together, not as in this case with the pulses planted three weeks after the grains. It is probable that sorghum will never mix well unless it is very widely spaced. A late pulse (*Vigna catjang, nseula*) planted in March has been tried with it, but without success.

The mixture of groundnuts and cotton (plot no. 6) was fairly successful. The groundnuts were planted on December 6 in 4 ft. rows, holes 12 inches apart ; cotton on December 24 down the middle of the 4 ft. rows, holes 2 ft. apart and two plants per hole. The yield of cotton was above the average for the station but the groundnut yield was lower. It is believed that the result would have been better had the cotton been planted on the same day as the groundnuts instead of 18 days later. It is also probable that the groundnuts could with advantage have been closer spaced, 2 rows between each row of cotton and the seeds 9 inches apart instead of 12.

On plot no. 7 the pigeon pea had been ratooned and was in its second year. White ants had killed approximately 50 per cent of the plants and where gaps occurred the cotton plants grew and bore well ; where the bushes had not been killed the shade was too much for the cotton and it died. A mixture which may prove to be a useful one from the point of view of providing ground cover is that of pigeon pea and green gram. The pigeon pea takes a long time to form cover and by the time it does so the green gram is ready for harvest. From observation made on a field planted with the mixture this year it would appear that the gram should be planted at the beginning of the rains and the pigeon pea about the middle of December. It is unlikely that any slow-growing crop will do well under the dense shade of pigeon pea. Millets which can grow away from and escape the shading effect or short-term crops which ripen quickly before the shade develops should be given further trials with pigeon pea.

On plot no.8 the stand of bush lima beans was so poor, in spite of repeated sowings, that there was practically a pure stand of cotton. The same land will be planted with this mixture every year and it will be interesting to see whether the beans do better in the future.

In plots nos. 9 and 10 damage by hoppers was so great that the results were negligible and observations useless. In the case of no. 9 the variety of *Pennisetum spicatum* was from India and like the local *nachacha (Pennisetum echinurus)* was awned and slow-maturing. It was destroyed before it ripened. The pigeon pea was eaten back to the pith but recovered slightly later and gave a small crop.

Locusts rather interfered with the cotton experimental work and no significant results were obtained from the spacing trial and strain test. In the time-of-planting trial the results, statistically, must be ignored as hoppers attacked the field, damaging one side particularly. The season was a bad one for late-planted cotton and the average yields of 12 lbs. per acre from the plots planted in March and of 215 lbs. per acre from the plots planted at the end of December do give a very fair idea of the case for and against early and late planting. Incidentally the decrease in yield as the planting date grew later was steady and regular. This steady decrease was similar to that of last year's results in which the highest average yield was from the plots planted on January 4, the second highest from those planted on February 1, the third from those planted on January 15 and the fourth, fifth and sixth in descending order as the dates grew later. Although the locust attack upset the significance of the results, it must be pointed out that the trials this year cannot be ignored. If results are only to be accepted in good seasons, when cotton planted from January to March does well, the experiments in time of planting are simply a waste of time. The results this season are particularly instructive in that they show the recuperative powers of well established cotton when attacked by locusts. This was displayed in the experimental cotton plots just as it was in the native garden. Under last season's conditions when the main hopper attack developed in February and March and the rainy season ended abruptly in April, late planting on either *mpala* or *dimba* land was a definitely unwise and dangerous proceeding. The experimental work merely emphasised what could be plainly seen all over the Lower River.

The Dimba Sub-station.—The crops on this station were a complete failure. Clearing was not commenced until March and by the time the land was ploughed and ready the rains had ceased.

All four fields were planted in April with maize but a visit from a flying swarm of locusts at the end of the month made replanting necessary; this second planting succumbed to the dry conditions during May.

Stock.—At the end of the year the head of cattle numbered 24, of sheep 82 and of goats 39. The number of plough oxen was reduced from 9 to 8 and of bullocks from 4 to 3 by another attack of trypanosomiasis early in May. The two bullocks were the only victims at the time and regular injections of antimony tartrate soon put the disease under control. Three healthy calves were born during July and August, with the loss of one cow in August, while the writer was on ulendo, through retention of the foetal membranes. During September two more work oxen died and blood slides showed the presence of trypanosomes. The rest of the herd was healthy and on further examination showed no signs of infection. One more calf was born towards the end of the year. One or two of the work oxen are showing signs of old age.

The silage made last year was fed to the cattle and was taken readily. Some more was made early this year, as already noted. No goat and sheep kraals were built during the year.

Buildings.—Under the Colonial Development Fund the following new buildings have been erected:—a guest house at the District Agricultural Officer's house; a combined seed-store and implement shed on the main (*mpala*) station; a farm building containing seed store, implement shed and office on the *dimba* sub-station. A well is also to be sunk here and the material is ready and the site chosen.

The writer is indebted to Mr. Barker for the facts relating to January, February and December of the year under review. As already stated, the writer returned from leave at the end of February and left the district at the end of November.

E. LAWRENCE,
District Agricultural Officer.

Table No. 1.

PORT HERALD EXPERIMENTAL STATION. METEOROLOGICAL RECORDS. 1932-33.

	Average monthly temperatures		Range of temperature		Rainfall		Average for previous six years
	Max.	Min.	Highest max.	Lowest min.	Inches	No. of days of rain.	Inches
1932							
November	95.4	72.6	109.0	59.0	4.17	7	* 1.93
December	93.5	75.1	107.0	71.0	14.28	17	* 6.71
1933							
January	91.0	77.8	98.0	69.5	3.75	10	6.93
February	90.3	73.5	100.5	68.5	5.03	9	4.09
March	93.3	72.9	95.5	67.5	0.87	5	5.82
April	87.9	69.2	99.5	62.0	2.32	9	1.97
May	85.0	64.0	93.5	56.0	0.24	2	0.57
June	84.5	62.0	94.5	53.0	0.35	4	0.64
July	84.0	60.8	91.0	55.0	0.44	3	0.42
August	85.9	61.1	97.0	55.0	0.69	3	0.36
September	89.0	65.7	103.5	55.0	—	—	0.24
October	98.2	72.0	108.0	61.0	0.16	3	0.25
November	97.8	74.8	109.0	63.0	1.25	6	2.30
December	88.2	73.3	98.0	69.0	9.71	12	9.56

* Average for previous five years only.

Total rainfall for the season, November 1932 to October 1933 = 32.30 inches
Total rainfall for year, 1933 = 24.81

Table No. 2.

LOWER RIVER RAINFALL 1932-33.

	Port Herald.		Chiromo.		Chikwawa.		Lower River Average
	Inches	Rain-days	Inches	Rain-days	Inches	Rain-days	Inches
1932							
November	4.17	7	2.57	?	3.05	?	3.26
December	14.28	17	10.63	?	9.38	17	11.43
1933							
January	3.75	10	2.68	9	5.33	10	3.92
February	5.03	9	4.00	7	3.57	8	4.20
March	0.87	5	1.03	7	1.90	5	1.26
April	2.32	9	3.06	9	1.61	6	2.33
May	0.24	2	0.22	2	0.44	1	0.30
June	0.35	4	0.13	3	0.23	3	0.24
July	0.44	3	0.23	2	0.22	2	0.30
August	0.69	3	A	—	nil	—	0.23
September	nil	—	nil	—	nil	—	nil
October	0.16	3	nil	—	0.42	3	0.19
November	1.25	6	2.30	4	1.40	5	1.65
December	9.71	12	4.77	11 ?	5.85	12	6.78
Yearly totals (1933)	24.81	64	18.42	54 ?	20.97	55(?)	21.40
Seasonal totals (Nov. 1932 to Oct. 1933)	32.30	72	24.55	?	28.05	?	27.66

A = unmeasurable quantity.

Table No. 3.

PORT HERALD COTTON STATION.

	1931			1932			1933		
	Max. temp.	Min. temp.	Rain. ins.	Max. temp.	Min. temp.	Rain. ins.	Max. temp.	Min. temp.	Rain. ins.
January	92.0	73.1	6.22	94.0	75.3	7.15	91.0	77.8	3.75
February	92.8	76.0	5.53	92.5	74.3	5.41	90.3	73.5	5.03
March	92.4	74.1	1.85	90.8	73.0	4.06	93.3	72.9	0.87
April	90.0	70.5	3.03	90.4	71.8	1.63	87.9	69.2	2.32
May	88.7	66.4	.23	84.1	66.0	1.37	85.0	64.0	0.24
June	80.9	58.5	.99	82.8	57.7	.23	84.5	62.0	0.35
July	83.2	59.2	.27	82.7	58.4	.41	84.0	60.8	0.44
August	90.1	62.4	—	81.5	58.3	.16	85.9	61.1	0.69
September	94.7	66.0	—	95.9	69.2	.51	89.0	65.7	—
October	100.0	72.9	1.10	98.2	72.9	.08	98.2	72.0	0.16
November	95.3	74.9	1.05	95.4	72.7	4.17	97.8	74.8	1.25
December	92.4	74.3	4.45	93.5	75.1	14.28	88.2	73.3	9.71
Total rainfall	...	24.63 inches		...	39.46 inches		...	24.81 inches	

	SEASON 1930-31	SEASON 1931-32	SEASON 1932-33
Seasonal rainfall Nov-Oct.	27.02 inches	26.51 inches	32.30 inches
Seasonal notes on crops.	March rains ineffective. *Mach.* good; *mapira* failed— insect attack and dry March. Cotton planted after February did nothing. Early planted Jan. and Feb. good. Good maize on dimbas. V. poor cotton year.	*Machewere* poor; *mapira* good; early planted cotton good; late planted cotton saved from complete failure by good rains in May; maize good; groundnuts good but some spoiled through delayed harvests and late rains; sweet potatoes good yield, no attack by *Cyclas compressus* Hartin.	*Machewere* good with small amount of locust damage. *Mapira* good growth but heavy locust infestation in March. Maize good everywhere but heavy loss from locusts in Chikwawa district. Cotton where planted late failed. Where planted in January and early February yielded well and recovered from locust attack. Sweet potatoes, with very large acreage planted, yielded well. Groundnuts with a smaller acreage gave a fair crop.

Table No. 4a.

Cotton Garden Census 1932—1933.

Chikwawa and Cholo Districts.

Principal Headmen	Cotton growers: Male	Female	Total	Cotton gardens: Large	Small	Total	Time of planting: Early	Feb. or March.	Late	Soil: Dimba	Mpala	No. of employees
Chikwawa District.												
Chipatula	2,146 ...	345 ...	2,491 ...	51 ...	2,517 ..	2,568 ...	384 ...	1,903 ...	281 ...	879 ...	1,689 ...	131
Beleu	284 ...	19 ...	303 ...	2 ...	303 ...	305 ...	129 ...	48 ...	128 ...	14 ...	291 ...	8
Ngabu	1,299 ...	297 ...	1,596 ...	11 ...	1,594 ...	1,605 ...	724 ...	546 ...	335 ...	819 ...	786 ...	26
Kasisi	400 ...	12 ...	412 ...	24 ...	393 ...	417 ...	239 ...	29 ...	149 ...	0 ...	417 ...	49
John	644 ...	150 ...	794 ...	4 ...	810 ...	814 ...	71 ...	719 ...	24 ...	266 ...	548 ...	11
Daniel	366 ...	33 ...	399 ...	21 ...	378 ...	399 ...	190 ...	171 ...	38 ...	77 ...	322 ...	35
Katunga	393 ...	57 ...	450 ...	20 ...	436 ...	456 ...	187 ...	173 ...	96 ...	167 ...	289 ...	34
	5,532 ...	913 ...	6,445 ...	133 ...	6,431 ...	6,564 ...	1,924 ...	3,589 ...	1,051 ...	2,222 ...	4,342 ...	294
Cholo District.*												
Ntondeza	457 ...	65 ...	522 ...	9 ...	535 ...	544 ...	164 ...	364 ...	16 ...	27 ...	517 ...	36
Total Chikwawa and Cholo:	5,989 ...	978 ...	6,967 ...	142 (2%) ...	6,966 ...	7,108 ...	2,088 (29.5%) ...	3,953 (55.6%) ...	1,067 (15.0%) ...	2,249 (31.6%) ...	4,859 (68.4%) ...	330

* These gardens lie along the Chiromo-Chikwawa road which passes for a short way through the Cholo district. Since all seed was obtained from the Chikwawa seed stores and all cotton was sold at the Chikwawa markets the figures are included.

Comparison of Totals of Four Seasons.

Year	Cotton growers: Male	Female	Total	Cotton gardens: Large	Small	Total			
1929-30	— ...	— ...	8,887 ...	— ...	— ...	9,565	Record crop year.		
1930-31	— ...	— ...	8,072 ...	— ...	— ...	8,652	Decrease of 815	growers	and 913 gardens.
1931-32	8,929 ...	320 ...	4,249 ...	628 ...	3,697 ...	4,323	„ 3,823	„	4,329 „
1932-33	5,989 ...	978 ...	6,967 ...	142 ...	6,966 ...	7,108	Increase of 2,718	„	2,785 „

Table No. 4b.

Cotton Garden Census 1932—1933.

Lower Shire District.

Principal Headmen	Cotton growers			Cotton gardens			Time of planting			Soil		No. of employees.
	Male	Female	Total	Large	Small	Total	Early	Feb. or March	Late	Dimba	Mpala	
Tengani	3,748	453	4,201	21	4,344	4,365	2,406	1,042	917	712	3,653	51
Mlolo	3,191	1,308	4,499	99	4,526	4,625	2,930	-	1,695	3,985	640	266
Chipwembwe	1,086	178	1,264	6	1,284	1,290	654	501	135	780	510	75
Ngabu	754	246	1,000	9	1,175	1,184	256	815	113	872	312	9
Chimombo	1,153	173	1,326	—	1,548	1,548	908	387	253	1,465	83	—
Nachikadza	1,862	651	2,513	24	2,851	2,875	1,067	965	843	2,875	—	83
Ndamera	1,688	218	1,906	26	2,085	2,111	1,252	128	731	1,232	879	84
	13,482	3,227	16,709	185 (1%)	17,813	17,998	9,473 (52.7%)	3,838 (21.3%)	4,687 (26%)	11,921 (66.2%)	6,077 (33.8%)	568

Comparison of Totals of Three Previous Seasons.

Year	Cotton growers			Cotton gardens			No of employees.	
	Male	Female	Total	Large	Small	Total		
1929-30	—	—	—	—	—	17,810		Record crop year
1930-31	10,759	2,383	13,142	388	13,491	13,879	1,109	Decrease of 3,931 gardens
1931-32	8,284	272	8,556	194	8,583	8,777	514	„ „ 5,102 „ & 4,586 growers
1932-33	13,482	3,227	16,709	185	17,813	17,998	568	Increase „ 9,221 „ & 8,153 „

Table No. 5a.

Cotton Garden Census.

Chikwawa District. Four Years Comparison.

Principal Headmen	Cotton growers Male	Female	Total	Cotton gardens Large	Small	Total	Season
Chipatula	—	—	2,946	—	—	3,316	1929-30
(Makwira)	—	—	3,060	—	—	3,366	1930-31
	1,916	221	2,137	394	1,701	2,195	1931-32
	2,146	345	2,491	51	2,517	2,568	1932-33
Beleu	—	—	1,143	—	—	1,163	1929-30
	—	—	629	—	—	633	1930-31
	158	5	143	19	124	143	1931-32
	284	19	303	2	303	305	1932-33
Ngabu	—	—	1,964	—	—	2,056	1929-30
	—	—	1,584	—	—	1,660	1930-31
	1,036	25	1,061	41	1,029	1,070	1931-32
	1,299	297	1,596	11	1,594	1,605	1932-33
Kasisi	—	—	841	—	—	863	1929-30
(Ndaeni)	—	—	770	—	—	784	1930-31
	156	5	161	14	147	161	1931-32
	400	12	412	24	393	417	1932-33
John	—	—	947	—	—	1,021	1929-30
	—	—	909	—	—	1,009	1930-31
	407	45	452	44	416	460	1931-32
	644	150	794	4	810	814	1932-33
Daniel	—	—	513	—	—	553	1929-30
	—	—	522	—	—	554	1930-31
	144	8	152	9	143	152	1931-32
	366	33	399	21	378	399	1932-33
Katunga	—	—	533	—	—	593	1929-30
	—	—	598	—	—	644	1930-31
	132	11	143	7	137	144	1931-32
	393	57	450	20	436	456	1932-33
Chikwawa	—	—	8,887	—	—	9,565	1929-30
Totals	—	—	8,072	—	—	8,652	1930-31
	3,929	320	4,249	628	3,697	5,323	1931-32
	5,532	913	6,445	133	6,431	6,564	1932-33
Ntondoza (Cholo)	457	65	522	9	535	544	1932-33

Note:—No previous figures for growers in Cholo district although undoubtedly many of present Cholo growers had cotton gardens in previous years but were included in the Chikwawa figures.

Season	Cotton seed issue lb.	No. of issues	Av. issue lb.	No. of cotton growers	No. of cotton gardens	Av. issue per grower	Av. issue per garden
1929-30	441,113	7,845	56.2	8,887	9,565	49.7	46.1
1930-31	449,480	7,163	62.7	8,072	8,652	51.9	55.7
1931-32	158,138	6,607	23.9	4,249	4,323	37.2	36.5
1932-33	331,690	13,527	24.5	6,967	7,108	47.6	46.7

The 1932-33 figures include the Cholo figures.

Note:—In 1931-32 season issues were restricted. Issues only made on hut-tax papers which had to be produced at time seed obtained. U4 seed issued for short time only and then Nyasaland Upland. Out of a total of 331,690 lb. of seed issued 28,530 lb. were U4 (1,904 issues out of 13,527).

Table No. 5 b.

Cotton Carden Census.

Lower Shire District.

Principal Headmen	Cotton growers Male	Female	Total	Cotton gardens Large	Small	Total	No. of employees	Year
Tengani	3,058	364	3,422	13	3,486	3,499	35	1930-31
	1,455	31	1,486	12	1,496	1,508	6	1931-32
	3,748	453	4,201	21	4,344	4,365	51	1932-33
Mlolo	2,484	842	3,326	225	3,297	3,522	591	1930-31
	2,764	41	2,805	126	2,787	2,913	417	1931-32
	3,191	1,308	4,499	99	4,526	4,625	266	1932-33
Chipwembwe	847	180	1,027	4	1,104	1,108	28	1930-31
	865	52	917	—	937	937	—	1931-32
	1,086	178	1,264	6	1,284	1,290	75	1932-33
Ngabu	633	220	853	10	850	860	26	1930-31
	476	42	518	8	506	514	12	1931-32
	754	246	1,000	9	1,175	1,184	9	1932-33
Chimombo	964	89	1,053	4	1,085	1,089	11	1930-31
	712	11	723	3	723	726	7	1931-32
	1,153	173	1,326	—	1,548	1,548	—	1932-33
Ndamera	1,119	221	1,340	90	1,294	1,384	357	1930-31
	622	20	642	32	641	673	43	1931-32
	1,688	218	1,906	26	2,085	2,111	84	1932-33
Nachikadza	1,654	467	2,121	42	2,375	2,417	61	1930-31
	1,390	75	1,465	13	1,493	1,506	29	1931-32
	1,862	651	2,513	24	2,851	2,875	83	1932-33
Lower Shire	10,759	2,383	13,142	388	13,491	13,879	1,109	1930-31
Totals	8,284	272	8,556	194	8,583	8,777	514	1931-32
	13,482	3,227	16,709	185	17,813	17,998	568	1932-33

Lower Shire District.

Year	Cottton seed issued lb.	No. of issues	Av. issue lb.	No. of cotton growers	No. of cotton gardens	Av. issue p/garden	Av. issue p/grower
1929-30	930,361	29,765	31.2		17,810	52.24	
1930-31	1,017,388	23,737	42.9	13,142	13,879	73.30	77.41
1931-32	250,682	11,557	21.8	8,556	8,777	28.56	29.30
1932-33	546,943	31,650	17.3	16,709	17,998	30.40	32.73

Note.— In 1931-32 season issues were restricted. Issues were only made on production of hut-tax papers and throughout the Lower Shire District U4 seed was issued for the first time.

Table No. 6.

Cotton Garden Census 1929—1932.

Chikwawa and Lower Shire Districts.

(including Cholo growers on Chiromo—Chikwawa road).

Year	Cotton growers			Cotton gardens			Time of planting			Soil		No. of employees	Remarks
	Male	Female	Total	Large	Small	Total	Early	Feb. or March.	Late	Dimba	Mpala		
1929-30	—	—	—	—		27,375							
1930-31	—	—	21,214	—		22,531							
1931-32	12,213	592	12,805	522	12,280	13,102							
1932-33	19,471	4,205	23,676	327	24,779	25,106	11,561	7,791	5,754	14,170	10,936	898	Including Cholo growers
	(82.2%)	(17.8%)		(1.3%)	(98.7%)		(46%)	(31%)	(23%)	(56.4%)	(45.6%)		

Year	Cotton seed issued lb.	No. of issues	Av. issued lb.	No. of cotton growers	No. of cotton gardens	Av. issue per grower lb.	Av. issue per garden lb.	Seed cottons produced lb.
1929-30	1,371,474	37,610	36.4 (b)		27,375		50.0	10,601,584
1930-31	1,466,866	30,900	47.4 (b)	21,214	22,531	69.2	65.0	5,547,001
1931-32	408,820	18,164	22.4 (a)	12,805	13,100	31.9	31.2	5,949,163
1932-33	878,633	45,177	19.4 (b)	23,676	25,106	37.1	35.0	6,494,228

(a) Issues restricted. 15 lb. seed only given to each grower on hut-tax paper. Larger growers more.

(b) Issues unrestricted. 1 petrol tin (holding 20—28 lbs.) per applicant.

Production Figures.

Average Production Seed Cotton (No. 1 grade only.)

Year	lb. per grower	lb. per garden	lb. per 1 lb. seed issued
1929-30	—	341.2	6.2
1930-31	261.5	246.2	3.7
1931-32	432.4	422.5	13.5
—	(465.0)	(454.0)	(14.5) = average production figures all grades.
1932-33	223.1	210.3	6.0
—	(270.1)	(258.6)	(7.4) = average production figures all grades.

Table No. 7.

NATIVE COTTON GARDENS, MEASUREMENTS AND YIELDS FROM INDIVIDUAL GARDENS.

District	No. of gardens measured	Total acreage measured	Total yield of seed cotton lb.	Average yield per acre lb.	Highest yield per acre lb.	Lowest yield per acre lb.	Size of average garden acres	Average yield per garden lb.
Chikwawa	25	44.36	15,012	338.41	682	67	1.77	600
Chiromo	32	59.59	21,930	368.01	1,250	88	1.86	685
Port Herald	43	38.20	12,293	320.80	1,297	74	0.89	286
Lower River	100	142.15	49,235	346,36	1,297	67	1.42	492.35

	Under 1 acre	Between 1-3 acres	Over 3 acres
Chikwawa	20 per cent.	60 per cent.	20 per cent.
Chiromo	22 ,, ,,	60 ,, ,,	18 ,, ,,
Port Herald	75 ,, ,,	22 ,, ,,	3 ,, ,,
Lower River	44 ,, ,,	44 ,, ,,	12 ,, ,,

Report of the District Agricultural Officer, North Nyasa.

I arrived in Nyasaland on first appointment in the middle of April and was posted to Karonga for duty in North Nyasa, arriving at the end of May.

Meteorological.

The seasonal rainfall registered at Karonga from November 1932 to May 1933 was 40.44 inches. This was 13.81 inches below the average for the previous five years.

Details are as follows:

Month	Rainfall	Number of days on which rain fell.
November	0.17 ...	1
December	4.60 ...	11
January	7.63 ...	18
February	13.58 ...	19
March	11.24 ...	19
April	2.83 ...	5
May	0.39 ...	3

Crops: General.

Native food crops throughout the district as a whole were good despite the locust invasion at the beginning of the planting season. There has been no sign of famine in any section.

Rice.

The rice crop of the season 1932-33 was a small one, due in part to the early cessation of the rains combined with late planting. This latter occurrence was brought about by the heavy infestation of locust hoppers in the Ngerenge rice areas which prevented the natives from the early hoeing and planting of their gardens.

Marketing. Rice was graded and bought at the Government rice store on the lake shore at Kaporo during July, August, and September. It had been decided that the middle of the three grades was unnecessary and, in consequence, only No. 1 and No. 2 were accepted. The price paid to the native was 4/- and 3/- respectively for a bag of 60 lb. In addition the sum of 1d. per bag was charged to cover all incidental costs such as bagging, sewing, handling, etc.

Total amount of rice purchased in North Nyasa: No. 1, 530 bags; No. 2, 980 bags.

Beans.

Beans (*Phaseolus vulgaris* vars.) are very extensively grown in the Misuku hills, where they form the staple diet of many natives. A market was established at Kaporo in conjunction with the rice market and 1,680 bags were purchased by Government. A further 200 bags were bought by a local trader for consumption in the district. A flat rate of 3/- per bag of 60 lb. was paid to the native, with a further 1d. per bag for handling charges, etc.

Coffee.

A start has been made in the establishment of a native coffee industry in the Henga valley. Nurseries of selected seed of *Coffea arabica* have been planted at Karamteta by the side of the Nchenicheni stream and a plot of land has been selected nearby for the ultimate demonstration plots. It is hoped to distribute hardy seedlings to selected natives during the planting season 1934-35.

Cotton.

There was virtually no cotton crop during the year under review, though a small amount of seed was distributed for Mr. Maxwell of Nyungwe Estate. It is proposed to reintroduce the crop during the coming season and 10 tons of improved *U4* seed is being issued to natives.

Cassava.

The cultivation of cassava would appear to be on the increase as natives are realizing its use as an effective indirect anti-locust measure. On the lake shore at the southern extremity of the district, it forms the staple crop of the populace.

Finger Millet.

Considerable deforestation is proceeding in the Misuku hills and elsewhere owing to the extensive burning practised for the growing of the finger millet crop. The erosion on the slopes is enormous and constitutes a very serious problem. Propaganda has been carried out and talks on this subject have been given in many villages.

A visit was made to Mzimba to observe a similar practice, there called *vizozo*. It was hoped to lay down experimental plots with a view to the investigation of this problem, but this has had to be postponed for a while.

Experimental Work.

Owing to the fact that the district was without the services of an agricultural officer during the rains of the season 1932-33, it has not been possible to carry out any experimental work this year.

Travelling.

A total of sixty-eight nights has been spent away from Karonga since the end of May. The Misuku hills, Nthalire, Mwenywenya, and Chikulamyembe have been visited on foot and the Henga valley both on foot and by road. Many visits were made to Kaporo and minor trips were done up and down the lake shore.

B. G. Charles,
District Agricultural Officer.

Annexure D.

Report of the Assistant Director and Agricultural Chemist.

So much of my time during 1933 was occupied by administrative work and so much of this was interwoven with work connected with the development of various export crops and the agricultural survey of central Nyasaland that it would be needless repetition to give in great detail various lines of investigation on crops, soils and climate when these have been or will be reported in full detail elsewhere.

1. Soil and Meteorological Investigations.

The completion and publication of two rainfall maps of the Protectorate has now been carried out. They cover the six dry months, May to October, and the six wet months, November to April; isohyets have been determined from records kept at various stations. Many planters to whom thanks are due have been very helpful in keeping records. Other records of temperature and humidity were also of great use in preparing a bulletin on the climate of central Nyasaland, in which the division of the country into agricultural zones was advocated.

Soil surveys naturally played a large part in the agricultural survey of 1933, and opportunity was taken at the time that land was being opened at Chimvua and Likuni for the new Lilongwe Experimental Station to obtain close co-operation between the acting Conservator of Forests, the Agricultural Superintendent of the Native Tobacco Board and myself in the description of profiles of types of the Likuni and other series and in the vegetation types found on the various soils. This ecological work was further extended by the collection of numerous grasses, many of which were sent to South Africa for identification. The study of root development of forest trees is to accompany this work.

Numerous soil samples from profiles exposed in large pits over all central Nyasaland were examined and described, and, furthermore, certain lateritic, both infertile and fertile, soils were sent to the Rothamsted laboratories for investigation. The Assistant Agricultural Chemist spent a considerable time in the field in many parts of central Nyasaland and in collecting some special soils from Makwapala which were also sent to Rothamsted for investigation.

The methods adopted in the laboratory examination of the soils collected by him and others are described in his report (annexure E). It is regretted that all the methods advocated at the conference of East African soil chemists could not be adopted in this survey work. It is considered, however, that his work on organic matter, pH values and indices of texture is of the highest importance in the preparation of maps and in development. Reference may be made to previous annual reports and to the report on the agricultural survey (in course of preparation) for further opinion on the values of analyses of clay fractions and of the organic matter of soil types.

2. Field Experiments and Seed Production.

The field experiments on the Zomba Experimental Station were continued on similar lines to those of previous seasons. A further set on similar lines was also commenced at Lilongwe. It is now proposed to publish the results of these experiments separately and for comparison side by side. The great importance of maintaining a correct proportion of organic matter in all red loam soils whether with a high or low silica-alumina ratio in the clay fraction is more than ever evident. The small returns from applications of lime, phosphates and potash to various crops in comparison with those from applications of organic materials were confirmed during the year.

Compost.—It is to be noted that the preparation of 170 tons of Indore compost on the Zomba Experimental Station during the dry season was very successful. Experience in various parts of Nyasaland shows that preparation during the wet season more often than not cannot be recommended. In the first place, the cattle concerned do not receive sufficient care either in adequate shelter or in the supply of sufficient bedding. If the latter is collected and stored during the dry season necessarily under shelter near the cattle sheds of the usual plantation, it usually means that time or funds available preclude the collection of material in sufficient amount for an appreciable compost manufacture. Furthermore, beyond this usual scarcity of dry material during the wet season, there is the much greater cost of cutting green grass, and the difficulty during the rains of obtaining the necessary high temperature in the stacks if these are exposed to the weather.

Funds do not admit of the extensive cover on the Zomba Experimental Station which is required for preparation of Indore compost during the wet season, and although, since Howard and Wad published their valuable treatise in 1931, attempts have twice been made to prepare compost cheaply and well during the wet season, these have now been given up and concentration is made on preparation of large quantities during the dry season in localities with high summer rainfall.

It is interesting to observe that the cost of making Indore compost works out at 3/- per ton as against 5/6 for a ton of Adco manure of similar composition.

Tea Soils.—The experiments on Lujeri tea soils with the kind permission of Mr. C. F. S. Shaw were continued during the year. No significant increases or improvement in the tea on certain brown soils have yet been obtained with various treatments.

Tobacco Seed.—Leaf measurements of selected and topped plants were continued in which valuable assistance was given by officials of the Native Tobacco Board. The requirements of *Western Dark Nyasa* seed in the Southern Province were supplied from the Zomba Experimental Station.

Plant Introductions.—These were primarily made with the object of the development of export crops in view. Such were 7 tons of white simsim, 558 trees of citrus, new varieties of sugar cane, seeds of tung oil, cashew nut, castor oil, tara bean, all of good type. Trials of good wheat varieties, seed of which was kindly given by the Department of Agriculture, Southern Rhodesia, were also commenced. Thanks are due in very large measure to Mr. A. B. Cormack of the Native Tobacco Board for the successful execution of the programme of work during the season of 1933.

3. Inspection and Extension Work.

Close co-operation continues to be maintained with officials of the Native Tobacco Board in matters connected with seed, diseases and field culture.

The visits of numerous headmen accompanied by the District Commissioner, Zomba, are worthy of mention. Much interest was shown in the work on small millets and other food crops. Some principal headmen from other parts of the Protectorate received lectures from Mr. A. B. Cormack in the field.

The vote for development of export crops enabled me to send a trial consignment of various produce to England and of three bales of bright tobacco under the Thorneycroft scheme of the Nyasaland Tobacco Association. This vote also enabled me to issue various seeds for the development of export crops and to purchase large quantities of seeds of groundnuts, simsim and small flat white maize of good quality with the same purpose in view. Citrus trees in large number were also obtained for trials in various parts of the country on the recommendation of Professor Clark Powell.

Coffee demonstration plots were opened and planted in Zomba and Cholo. Terracing and manuring received an impetus in the Masambanjati area of Native Authority Ntondeza.

A serious attack was at last launched on the West African tobacco market, a great incentive being the preferential duty in Gambia and Sierra Leone. I was enabled from my previous experience of tobacco for this market to instruct the firm concerned in correct methods of preparation and that a large repeat order has since been obtained is an indication of success.

The monthly crop and market reports were prepared by me during the year and reference may be made to these for various matters connected with crops and crop observations.

I was a member of the Native Tobacco Board and of the Board of Agriculture and its committees during the year and necessarily took the place of the Director of Agriculture as chairman whilst he was on leave. The work of these bodies has been reported elsewhere and need have no place in this report. I was also chairman of the Fertilizers Sub-committee of the Nyasaland Tobacco Association, whose report was issued during the year.

A. J. W. Hornby,
Asst. Director of Agriculture and Agricultural Chemist.

Report of the Assistant Agricultural Chemist.

The work for the year 1933 can be conveniently divided into:—

1. Investigation of soils from the agricultural survey.
2. General soil work.
3. Investigation of the preparation of organic manure.
4. Experimental treatment of tobacco for the West African market.
5. Miscellaneous chemical and analytical work.
6. Seed distribution to natives.

1. Investigation of Soils from the Agricultural Survey.

During the course of the agricultural survey of central Nyasaland it was considered advisable to supplement the field observations of soils by laboratory examinations of representative types. In accordance with this plan, the importance of studying soils by profiles was impressed on all surveyors and instructions for describing and sampling profiles were issued by the Assistant Director of Agriculture and Agricultural Chemist.

A very large number of soil samples has now been received and laboratory work on these is in progress. In view of the quantity of samples to be examined, it has been considered advisable to carry out the work by means of a standardised series of rapid analytical methods, designed to ensure recognition of general similarities and dissimilarities, and to supplement these methods by more detailed ones in cases of special interest.

The preliminary examination involves the following determinations:—

1. The acidity of the soil throughout the profile.
2. The gravel contents throughout the profile.
3. The index of texture throughout the profile.
4. The organic matter throughout the profile.

Of these determinations 1. and 2. are carried out quite simply, the acidity being found by the quinhydrone electrode and the gravel by standard sieves.

The index of texture is a relatively easily determined constant expressing the mechanical qualities of the soil and was proposed by Professor Hardy of the Imperial College of Tropical Agriculture, Trinidad (1). The chief advantages of this method are that it eliminates some of the time and labour involved in a complete mechanical analysis and that it gives a single-valued constant expressing the texture of the soil.

The method employed for the determination of organic matter is a rapid one which was worked out by the writer in collaboration with Dr. A. Walkley at Rothamsted Experimental Station in 1932 (2). The method is not claimed as an exact one but it was found to give approximately correct figures with many different types of English soils and to agree well with other rapid organic matter determinations when applied to Nyasaland soils.

In connection with this survey work, it may be of interest to note that Mr. Carver of the Forestry Department supplied a number of soil samples from areas in the Northern Province representative of definite forest types and that these soils have been submitted to the same type of analysis. It is hoped, and there are indications, that it may be possible to correlate the vegetation and the soil with sufficient exactness to enable good agricultural soils to be identified by the natural vegetation,

During the year more than 300 individual soil samples have been examined by these methods and the results are being prepared in graphical form which will greatly facilitate classification.

2. General Soil Work.

During the year under review soils have been received from planters for examination, and advice has been given as to the crop most suitable for the soil or the fertiliser treatment best suited to a particular crop.

A series of brown soils, from an area of Lujeri Tea Estate which has a bad reputation for the disease known as *yellows* was analysed, and it was found that the contents of sulphur, calcium and magnesium were notably low. With the co-operation of Mr. Shaw of Lujeri experimental plots, arranged as randomised blocks, were established on the soils and these field experiments are designed to determine the effects of calcium, magnesium and sulphur on the incidence of *yellows*.

At the request of Mr. Ducker of the Empire Cotton Growing Corporation the soils of Makwapala Experimental Station were studied in considerable detail. A series of sample pits was selected and described and a comprehensive selection of samples was obtained. These samples were sent to Rothamsted Experimental Station by the Empire Cotton Growing Corporation for detailed investigation, and it is hoped that information may be obtained regarding the physical and chemical causes of iron pan formation in the red soils of Nyasaland.

3. Investigation of the Preparation of Organic Manure.

Considerable attention has been given to the method of preparing organic composts designed by Mr. A. Howard (3) of the Institute of Plant Industry, Indore, and to the modification of the method which has been employed for some years by Messrs. Ducker and Miller at the Makwapala Empire Cotton Growing Corporation Station.

A lecture was given to the Tea Research Association at Cholo on May 12 dealing with the theory and application of these methods and considerable interest was shown by planters. The substance of this lecture was combined with material from a previous lecture by the Assistant Director of Agriculture into a circular which was sent to a large number of planters.

The practical aspects of both the Indore and Makwapala methods were investigated at the Zomba Experimental Station in conjunction with the Assistant Director of Agriculture and Mr. Cormack. With both methods the results were highly satisfactory and this work afforded data which enabled an additional circular to be compiled containing definite instructions for preparing a satisfactory compost in this country.

The compost prepared at Zomba has been tried on certain fields at the experimental station and, while it is too early to give a final opinion, preliminary observations indicate that the compost is equal to, if not better than, farmyard manure.

4. Experimental Treatment of Tobacco for the West African Market.

Part of this work was undertaken in collaboration with the Assistant Director of Agriculture. The use of certain flavouring matters and steaming treatments was suggested and the preparation of five experimental bales was supervised. This tobacco was designed to suit the markets in the Gambia and Sierra Leone and preliminary reports from these colonies indicated that the tobacco from the experimental bales was satisfactory and commanded a ready sale. Similar work was undertaken to produce a tobacco for the Nigerian market.

5. Miscellaneous Chemical and Analytical Work.

Throughout the year a considerable amount of general chemical work has been done. The most important of this was as follows.—

1. Series of mineral analyses of well waters which were submitted by the Director of Geological Survey. The majority of this work was carried out in 1932 but it has not previously been reported.

2. The isolation and preliminary examination of oil from Mlanje Cedar (*Widdringtonia Whytei*) was undertaken at the request of the Conservator of Forests. As a result of this work samples of oil were obtained which, along with samples of the wood, were sent to the Imperial Institute for a detailed examination for which the Zomba laboratory was unsuitable.

As in previous years the Veterinary Department has been supplied with standardised decinormal iodine for dip testing and a number of stomach samples have been tested for arsenic in cases of suspected dip poisoning.

6. Seed Distribution to Natives.

During December the distribution of seeds to natives in the area surrounding the northern extension of Nyasaland Railways Ltd. was undertaken. This necessitated more or less continuous travelling on the railway, by means of construction trains and trolleys, and so headquarters were made at Balaka Station.

The work of distribution was greatly assisted by the District Agricultural Officer, Zomba, who took charge of the section from Blantyre to Balaka Station, and by the Rev. Father Braire of Ntakataka Mission, who rendered invaluable help in the Dedza district which was frequently inaccessible on account of wash-outs on the line during the rains.

The chief seeds distributed were cotton and groundnuts, the latter being sold to the natives. The natives generally, probably owing to poor prices in previous years, were unwilling to plant much cotton except in the Salima and Domira Bay areas. On the other hand, there was a fair demand for groundnuts at all parts of the railway.

Distribution was still in progress at the end of December and, as natives are still taking seed in considerable amounts, it is probable that the work will continue throughout January 1934. It is thus impossible to produce figures for the distribution in this report.

Very hearty thanks are due to the Chief Engineer (Construction) and all members of the staff of the northern extension for their unfailing kindness and helpfulness during the seed work, and to the railway company for placing free transport, both for personnel and seeds, at the disposal of the Department of Agriculture.

References.

1. F. Hardy. (1928) Journ. Agric. Sci. 18, 252.
2. A. Walkley & I. Armstrong Black. (1934) Soil Sci. 37, 29.
3. Howard and Wad. *The Waste Products of Agriculture.*

Ian Armstrong Black,
Assistant Agricultural Chemist.

Report of the Entomologist.

In common with the rest of southern-central Africa, the Protectorate was affected during the year 1933 by the development and spread of the red-winged locust (*Nomadacris septemfasciata*, Serv.) rapidly following the invasion by the hairy-chested locust (*Locusta migratorioides*, R and F.) in the latter part of the previous year. The organisation, to suit the local difficulties, of the meagre resources available in the country to keep the probable damage as small as possible and concentration on the study of these pests brought all other entomological work practically to a standstill.

Locusts.

To obtain a clear picture of the whole locust situation during 1933 it will be necessary to recapitulate briefly the occurrences at the latter end of 1932, and later to refer to the early months of 1934.

Invasion of the Protectorate by both species of locust took place in each case at two distinct points, and for the sake of clarity the distribution of these with the resulting egg-laying and hopper swarms will be dealt separately.

(1) *Locusta migratorioides.*

(*a*) North Nyasa.—The invasion of this district was mainly confined to the lake littoral, from the Songwe river to Florence Bay, by flying swarms arriving from Tanganyika Territory during November and December, 1932. Egg-laying took place almost immediately and large numbers of hopper swarms developed during December 1932 and January 1933. Hoppers were also reported in the Nthalire-Mweniwenya area, to the west, early in February. The lakeshore belt of infestation was intimately connected with the heavy infestation of the Mwaya-Ipiana plain of Tanganyika Territory, many hopper swarms even crossing the Songwe river from there into Nyasaland.

(*b*) Remainder of the Protectorate.—The line of invasion of the swarms that were responsible for covering the greater part of the Protectorate was from Portuguese territory at the south-east corner of Lake Nyasa. The invasion occurred mainly during September, 1932 (for details see Annual Report 1932). The first flying swarms that traversed the length of the Protectorate from the southern end of the lake to the Lower Shire district and thence into the Zambezi valley did not lay eggs at all in this country. The egg-laying swarms that followed had mainly died out by the time they reached the southern boundary of the Blantyre district, with the result that the Chikwawa and Lower River districts produced no hopper swarms, and remained practically free from this locust except for some scattered groups that arrived mixed up with flying *Nomadacris* swarms in January 1933. Egg-laying took place towards the end of November 1932 and the areas in which hopper swarms developed during December were mainly confined to the South Nyasa district, the line of the Shire river valley (chiefly on the western side) to the southern boundary of the Blantyre district, and the Lisungwe river valley.

(2) *Nomadacris septemfasciata*

(*a*) Chikwawa and Lower Shire.—Very early in January 1933 and quite possibly during the latter part of December 1932 these districts were invaded by large flying swarms from the west. There was some confusion at first as to the species, but later it became evident that the majority were *Nomadacris* with only a small proportion of *Locusta* mixed up with them. Very extensive egg-laying took place immediately, extending into the southern end of the Cholo districts and these swarms were also, doubtless, responsible for egg-laying in Portuguese territory to the east of the Shire and Ruo rivers. Hopper swarms of considerable magnitude developed during January and February, not only on the line of the Shire river but also in the hill country and in the large uninhabited tracts that exist in these districts.

(*b*) Remainder of the Protectorate.—Mature swarms of considerable size arrived at Fort Manning from Fort Jameson in north-eastern Rhodesia between December 24, 1932 and January 6, 1933. Other swarms penetrated into the Kasungu district from the vicinity of Lundazi on about January 2. A considerable amount of egg-laying took place immediately in the Fort Manning, Kasungu and Lilongwe districts, but a number of swarms continued to move strongly in a southerly and easterly direction. By the end of January these swarms had penetrated east to the lake shore and as far south as Blantyre, and had deposited eggs in practically all districts from Kasungu to Blantyre. Oviposition, however, became less intense as the southern point of the migration was reached, and resulted in an area free from locusts dividing this northern invasion from that of the west and south-west. Hatching occurred from the end of January to the middle of February and the areas most seriously affected were as follows: (1) Along the Bua river in the Fort Manning district into the western portion of the Kasungu and Dowa districts, and from Fort Manning to Lilongwe, becoming less serious to the east of the latter place; (2) The lake shore area of the Dowa and Dedza districts; (3) The South Nyasa district following the Shire river valley southwards into the Liwonde and Utale areas of the Upper Shire district.

The swarms of *Locusta* that arrived in 1932 were adults of the tenth generation since the commencement of the locust cycle, and the resulting hoppers were the beginning of the eleventh. In the case of *Nomadacris* the swarms arriving in 1932-1933 were the sixth generation giving rise to hoppers of the seventh. * The development and movement of adults of these eleventh and seventh generations respectively are dealt with separately as before.

(1) *Locusta migratorioides.*

(a) North Nyasa.—Flying swarms developed towards the end of January and were supplemented by swarms from across the border in Tanganyika Territory. Owing to the nature of the country and lack of observers it was difficult to obtain accurate information as to the further movement of these swarms. It is probable that they moved into the Nyika hills and possibly travelled as far as north-eastern Rhodesia, as a few maize gardens in the Nyungwe-Mwafulirwa area were reported as being damaged in March. From April to July there were only reports of a few swarms that crossed the western border from north-eastern Rhodesia early in April, slightly damaged a few native gardens and returned whence they had come. It is assumed that these were *Locusta.* From July onwards reports referred generally to *Nomadacris,* being confirmed by specimens in many cases, but at the same time a certain number of *Locusta* must have remained in the district during the dry weather, either as individual swarms or mixed up with *Nomadacris* swarms. One such individual swarm was observed on the Nyika plateau towards the end of December, and hoppers, confirmed by specimens, were found a few miles south of Karonga on December 22. Hoppers of this species were also obtained from the Nyondo-Fort Hill area in January 1934. On the whole, however, the North Nyasa district, as will be seen from the description given later of the movements of *Nomadacris* in the district, remained astonishingly free from locust development during the 1933-34 period.

(b) Remainder of the Protectorate.—Hopper swarms were mostprevalent in the South Nyasa and Upper Shire districts and new flying swarms developed from these early in January. In the former case the majority would appear to have passed over the border between Namwera and Fort MaGuire into Portuguese territory. In the latter case a few swarms passed through the Ncheu and Dedza districts and partly into Portuguese territory in the vicinity of Dedza. Whether a second brood of hoppers was produced by any of these swarms it is difficult to say as by March the situation was much obscured by the advent of *Nomadacris.* At any rate it was of no magnitude. Some copulation and a few hopper swarms, unfortunately never properly confirmed, were reported in the South Nyasa district in March, two flying swarms passed north-east through Namwera in June, and newly developed adults were caught on Nchisi Island in Lake Shilwa in April. Quite a number of the adults showed characters, such as a distinctly arched pronotum, indicating a possible development, though by no means advanced, towards the phase *solitaria* (*dissocians*). A single specimen with this character very pronounced and with definitely green colouration was obtained from a swarm that circulated in the Makanjira area of South Nyasa on the international border on January 14.

During February and March scattered groups of *Locusta* hoppers were to be found among the majority of *Nomadacris* hopper swarms throughout the country, There is little doubt that these were offspring of *Locusta* adults that were mixed up with the *Nomadacris* flying swarms, and many of these hoppers had a decidedly different colouring to that of normal *Locusta* hopper swarms.

Although during the dry season flying swarms of *Locusta* were scarcely reported at all and ceased to be of any importance compared with *Nomadacris,* adults were frequently to be found among flying swarms of the latter and continued to be present up to January 1934, while adults of a new generation developed among the *Nomadacris* hoppers in February of that year.

(2) *Nomadacris septemfasciata.*

(a) Chikwawa and Lower Shire.—In these districts the first flying swarms were recorded on March 20 in the Chiromo area of the Lower Shire district and on March 28 in the Makwira area of the Chikwawa district. The development of other flying swarms rapidly followed during the first two weeks of April over the whole of the two districts.

The earliness of these flying swarms here in comparison with the rest of the Protectorate supports the contention that these districts received a separate initial invasion. The original movement of these swarms followed no very definite direction though there was some tendency, noticed also elsewhere, to leave the lower levels and enter the foothills. This tendency led, naturally, in the Chikwawa district to a northerly or north-easterly trend. Later, however, from May to July there was a more or less continuous move of swarms from south to north, particularly through the Lower Shire district, some of them entering the district from Portuguese territory to the south. This movement became more intensified during August and September and a large number of the swarms crossed the Shire river into Portuguese territory between Port Herald and Chiromo. Doubtless this movement was responsible, in part at any rate, for the heavy infestation reported later in the vicinity of Derre and Chiperone hills in that territory. In September also, and during October, the concentration of the swarms in the foothills was a noticeable feature. Where definite movement was observed it continued in a north-easterly or north-westerly direction, never to the south, but circling flights from the foothills to the plains and back again were of almost daily occurrence. A large number of swarms were concentrated along the hills of the Cholo-Chikwawa border. At the beginning of November, swarms, in which the sexually mature yellow colour had developed, were recorded moving in a northerly direction, some still entering the district across the southern border. Although egg-laying was not reported until November 8

* H.M. Stationery Office Publication 63-80-2.1933.

hoppers began to hatch some seven miles south of Chiromo on the 23rd of the month, proving that eggs must have been laid towards the end of October. Egg-laying appeared to continue over a long period (up to the end of January 1934), and during December flying swarms were recorded as moving from *north to south* for the first time yet still inclined to turn east into Portuguese territory. Hopper swarms continued to develop during November and December and into January 1934 throughout the whole of the two districts. As a result of this prolonged egg-laying and hatching period, by January 1934 there were hopper swarms in the final stage of development in the same areas as newly hatched swarms only a few days old. Early in February 1934 the first flying swarms (8th generation) were reported from the Elephant Marsh, though it seems probable from the date of the initial egg-laying that some flying swarms must have developed earlier, towards the end of January 1934. The initial movement of these flying swarms was a circling flight, to and fro, across the Shire river.

(*b*) *Remainder of the Protectorate.*—In all the areas infected with hopper swarms new flying swarms developed during April. Accurate records are as follows :—Domira Bay, 16th., Liwonde 18th., Fort Johnston, 19th., and Bwanje Valley, 25th. Generally speaking the first movement of these swarms was, as noted also in the Lower River areas, to forsake the lower levels and concentrate in the more hilly country. In the case of the lake shore areas this produced a north and north-westerly movement into the Dowa and Dedza hills, and a fairly well-defined north-easterly movement into the Mangoche and Namwera hills of the South Nyasa district. Elsewhere the movement brought numbers of swarms from the Shire valley to the Zomba-Malosa range of hills, and from other sources to the slopes of Mlanje mountain. From these elevated areas circling flights continued throughout the dry season. By June, however, some districts, notably Fort Manning, Kasungu, Dowa, and Lilongwe, recorded definite movement to the north or north-west as already having taken place, with the result that these districts appeared to be free from locusts for some considerable time. In the light of later information, however, it seems fairly definite that the swarms had concentrated in the sparsely or totally uninhabited areas such as the Dzalanyama range of hills, the Fort Altson game reserve in the Kasungu district and probably all along the western boundary of the Protectorate. Further south, where observation was more feasible, swarms moving in every conceivable direction were recorded continuously, but, commencing in October and becoming very marked throughout November and December, there was a very decided northerly and north-easterly movement. Between parallels 15.° and 16°S this took a very large number of the swarms, which were rapidly becoming sexually mature and almost ready to lay eggs, through the Zomba and Mlanje districts and across the eastern international boundary.

At the same time a somewhat similar movement was responsible for swarms re-appearing throughout the Fort Manning, Kasungu, Lilongwe and Dowa districts, the lake shore being again infested by the middle of December.

Early in December swarms had entered the northern portion of Momberas district from north-eastern Rhodesia but turned south through the West Nyasa district. During the whole of the month swarms were moving from south to north through the North Nyasa district. The origin of some of these more northerly swarms was not altogether clear, but as during September there was also some slight movement southwards through the West Nyasa district and along the Henga valley it would appear that swarms had concentrated previously in the Nyika plateau. The main migratory movement northwards before the onset of the rains carried the majority of these swarms across the Songwe river into Tanganyika Territory, and though egg-laying took place on a very small scale during December the expected heavy infestation, comparable with the 1932-33 period, did not occur and North Nyasa remained practically free of hopper swarms. A few swarms developed in Momberas district, mainly to the western side, and a few in the West Nyasa and Kota-Kota districts.

The main infestation, however, covered much the same area as before, that is to say, from Fort Manning and Kasungu to the lake shore, southwards in every district to Cholo and through the Chiradzulu and Mlanje districts, which two latter had not previously been affected. Some early egg-laying took place in November, but general oviposition occurred throughout December 1933 and January 1934. A rather similar position to that which has already been described as arising in the Lower River districts had thus developed early in the new year (1934), hopper swarms of all ages being found in practically all districts. These hopper swarms were, however; generally of small dimensions particularly those emanating from the earlier layings, and as a consequence natives were able to inflict much greater destruction on them than was possible in the previous period and in many cases they were completely annihilated. The later developing swarms were severely affected by disease and parasites early in 1934, and as a consequence of all these factors not only was the number of hopper swarms that reached maturity considerably less than was anticipated but also the date by which new flying swarms developed was considerably later than would otherwise have been the case. The first flying swarm recorded from the South Nyasa district was on February 23, 1934 from hoppers that hatched on December 19, 1933 ; elsewhere flying swarms did not seem to appear until the following month.

Anti-locust Measures.—As stated in the last annual report any intensive campaign against locusts being financially impossible, a policy of crop protection was adopted and this was continued during the hopper periods of both the beginning and end of the year. Such a policy was interpreted to mean not only the actual control by Europeans or native police and patrols of large numbers of natives engaged in destroying hopper swarms that were definitely menacing particular areas but also the continual encouragement of the natives to protect their crops themselves by that extra effort which they would be unlikely to produce if left alone. For this purpose the employment of temporary European locust officers, native patrols and police was maintained as

ong as possible in those areas where such control would be of most importance and administrative officers were untiring in their efforts to get the native population to realise the gravity of the situation. The personnel of the Native Tobacco Board, while carrying out their normal duties, wer responsible for much valuable propaganda work. It would be difficult also to assess theg valeue of the assistance given voluntarily by Europeans throughout the Protectorate in encouragin and persuading natives to take action to protect their gardens.

It may seem that such measures would be futile and must have failed to do any real good, and in many cases the results certainly appeared disheartening, particularly at the beginning of the year. But several important facts must be taken into consideration; there was the general apathy of the native to such a disaster as the possible destruction of his food crops by locusts, a disaster of which only the older people had had any experience; there was his antipathy to dealing with the hoppers in any way before they were sufficiently grown to provide a suitable food supply; and there was the fact that in certain places, such as the South Nyasa and Upper Shire districts, having dealt reasonably well with *Locusta* hopper swarms, he found himself called upon to combat still larger *Nomadacris* swarms immediately afterwards.

If a certain amount of luck must be conceded in that, owing to the late development of the *Nomadacris* swarms, the food crops were in the main harvested before serious damage was done to them, the fact that nowhere in the Protectorate were relief measures found to be necessary would seem to prove that the action taken was effective to a considerable degree.

Propaganda as to further locust development and the necessity for planting extra quantities of food crops of a nature least likely to be attacked was continued throughout the year. The results in the 1933-34 period showed that this propaganda had borne fruit and moreover with the coming into force of the Native Authorities Ordinance it was found that a number of the Native Authorities were prepared to, and did, on their own initiative, take protective action on the lines that they had been shown previously, although it must be admitted that the manner in which the hopper swarms developed in the 1933-34 period, as described above, undoubtedly enhanced the success that attended their small efforts.

Only those who have had personal experience of destroying, by mechanical means and with native labour, a hopper swarm of even moderate dimensions can realise all that it entails and it would be very unfair to pass lightly over the steady, continuous work performed by administrative officers, locust officers and those who gave voluntary assistance. In such work failure is more easily remembered than success, but that the little damage to food crops in both seasons is due largely to this work, even admitting a certain amount of luck, cannot be denied.

As regards the actual destruction measures employed, the ordinary primitive means had to be relied upon. Trenching was only of value under European supervision, natives appearing incapable of carrying out such work by themselves except on a very small scale. In many cases, however, the measure adopted was not only dependent on the requirements of the particular situation but was also largely influenced by the possibility of the natives concerned securing a reasonable quantity of the hoppers for food. When the *Nomadacris* hopper swarms first developed, very little was known about their habits and fresh difficulties thus arose. It was quickly learnt that little successful action could be taken as a rule for the first three weeks after hatching. It was also found that the hoppers of this species preferred to remain in thick grass or other vegetation and that stretches of bare ground, though not actually impeding their progress, constituted an obstacle that frequently deflected their direction. It was thought that this fact might be turned to advantage if good-sized belts of cleared land were constructed round the gardens. Naturally this was not possible in a very large number of areas, but where it was carried out it was demonstrated to be of very considerable assistance by checking the advance of the swarm and permitting further action to be taken in time. The results from what would appear to have been an eminently feasible practice were, however, disappointingly small, owing to the natives' lack of energy to clear a belt that was wide enough to give the desired result or their natural procrastination so that no attempt was made until too late to prevent the swarms entering the gardens.

During the 1933-34 hopper period a small quantity of sodium arsenite was imported from South Africa. This was distributed to and used by locust officers and certain Europeans on a restricted scale with the intention of getting natives used to the idea of hopper swarms being poisoned, should finances permit or the situation warrant extensive use of the poison in the future. In a country where locusts are fed upon by indigenous races to the extent that occurs in Nyasaland the introduction of poison spraying on a large scale must be undertaken with considerable care, because not only are the hoppers collected in quantity by the women-folk but natives travelling about the country will snatch a few handfuls of the insects from any swarm they may pass. Given a sufficiently large organisation this difficulty could be overcome, but the control of grazing flocks and herds under local conditions would constitute a greater, though by no means insuperable, problem.

The main limiting factor in using poison extensively throughout the Protectorate would be transport. In addition, if poisoning was adopted as the main combative measure, the natives would undoubtedly cease to carry out even the small amount of protection work that they have done up to the present.

Loss of Crops.—It is scarcely possible to state the total amount of damage in terms of money. Only one export crop, cotton, suffered to any extent and that chiefly in the Lower Shire and Chikwawa districts. In these two districts the cotton was attacked by hoppers in February and March 1933, most damage occurring towards the end of the latter month. It is estimated that of the 23,000 cotton gardens in these districts, 20 per cent. were attacked of which half were

totally destroyed. Young or late-planted cotton was most severely affected, but older plants just flowering, even if eaten right back to the ground, sent out new shoots and in most cases gave a fair yield. Most of the late-planted cotton yielded very poorly during this season, and the total reduction of the crop that can be directly ascribed to locust attack probably did not exceed 7 per cent. This would represent 213 tons of seed cotton worth approximately £1,263 to the native growers.

At the experimental station of the Empire Cotton Growing Corporation on the lake-shore level near Domira Bay, a loss of 25 lb. of lint per acre was estimated as due to damage by new flying swarms in the early months of 1933.

The crops that suffered most, as was only to be expected, were the various native grain crops. In certain areas the loss was fairly heavy, particularly in the Chiromo section of the Lower Shire and the Utale section of the Upper Shire districts. Approximate figures of the losses occurring in one section of the Chiromo area and in the Chikwawa district are given below.

Chiromo (Tengani's section).			Chikwawa district		
Crop	Normal yield	Loss 1933	Crop	Normal yield	Loss 1933
Sorghums	3,600 tons	75 per cent.	Maize	10,250 tons	30 per cent.
Other millets and maize	5,400 tons	10 per cent.	Millets	600 tons	30 per cent.

In the Chikwawa district the maize crop suffered heavily in places, the loss in some parts of the northern area being as high as 75 per cent., but the reduction in the yield of millets was not so serious here as in the Lower Shire district where these grains are the most important food crop. In the Port Herald area of the Lower Shire district the total loss did not exceed 3-4 per cent. of the total yield. It is estimated that, over the whole of the Chikwawa and Lower Shire districts, ocust damage reduced the total grain yield by about 15 per cent. Throughout the two districts lhe loss of these grains was intensified by the normal damage from grain-eating birds being oncentrated on the gardens that were not destroyed by the locusts.

The flying swarms during the dry season confined their attention mainly to the foliage of jungle trees, though fruit trees were attacked on several occasions and the bean and pea crop in North Nyasa suffered considerable damage later in the year.

If the apathy of the native in the face of a locust invasion is an obstacle that can only be surmounted with difficulty, at least the same apathy appears to some extent in his attitude towards a slight food shortage. Among a native population that can in time of stress add a number of edible wild fruits, seeds and various plants to its diet a locust invasion has got to be very severe to produce a serious famine. Under European planting conditions of cereals the ravages of the pest are, naturally, much more intense. Nyasaland, very fortunately, has not suffered yet to the extent that has occurred in neighbouring territories, but it must not be considered that the danger is completely past.

Food of Hoppers.—Although locusts in general are recognised to feed mainly on cereals and other grasses, *Nomadacris* hoppers would seem to find palatable a wide range of plants. The vagaries in their feeding habits, however, render it difficult to state authoritatively what are and what are not preferred food plants, as a certain crop or plant may be utterly destroyed in one place and remain completely untouched elsewhere. Moreover the recuperative power of certain plants is so astounding that observations recording total destruction of a particular crop may have to be contradicated a few weeks later. In the case of hoppers feeding on *Gramineae*, usually the midrib is left uneaten and, as a result, areas of the coarser jungle grasses on which swarms have fed provide a striking spectacle of upstanding white threads. The lists given below do not profess to be comprehensive, but they are compiled only from observations that have been verified a number of times. The first list is not intended to mean that these plants are *invariably* totally destroyed but that they have been on occasion.

1. *Destroyed.*

Maize—to nearly hard grain stage. Sheaths and cobs attacked and thick stalks eaten to ground level by the older hoppers.

Millets—*Sorghums*, all species (vern. *mapira* etc.)

Additional damage done by the pedicel of the seed-heads being eaten through.

Pennisetum typhoideum and other spp. (vern. *machewere* etc.)

Eleusine coracana (vern. *mawere* etc.)

Rice—

Grasses—*Pennisetum purpureum* (vern. *nsanjire)*, in particular.

? (vern. *nsatu*) Lilongwe district.

Bamboo—young shoots in particular.

Sugar-cane—rapidly devoured.

Cotton—mainly in young stage.

Groundnuts—may be completely defoliated in young stage.

Banana—complete defoliation but recovery general.

Cajanus indicus (vern. *nandolo*)—barked as well as defoliated.

Phaseolus sp. (vern. *cimamba*) Lower River districts.

Wild Abutilon

2 *Slightly attacked.*

Cowpea (*Vigna sinensis*)

Cassava—stalks eaten to pith, as well as defoliated.

Tung Oil—a few plants among attacked cassava.

Sisal—in abandoned plantations.

Mango.

3. *Not attacked.*

Sweet potato, native pumpkins and gourds, cucumber, *Hibiscus esculentus* (vern. *terere*), tobacco, *Phaseolus mungo* (vern. *mpodza*), *Sesamum indicum*, simsim (vern. *chitowe*), Bambarra groundnut (*Voandzeia subterranea*).

Feeding of Adults.—The feeding habits of the adult swarms are very irregular. Feeding may apparently take place at any time of the day, though generally it was most noticeable when a swarm settled for the night, and the noise of the action could then be heard for a considerable time after dark. Spasmodic feeding was also observed among swarms in the early morning before flight commenced. Under local conditions, the natural habit of the newly matured flying swarms confines them very largely to the forest trees, though any cereals with which they come in contact are liable to be destroyed, and they are practically omivorous. The following crops and plants, other than cereals and grasses, suffered to a greater or lesser extent:

Beans and peas of all kinds; on one occasion Tepary beans (*Phaseolus acutifolius*) among groundnuts were destroyed and the latter untouched; nearly all vegetables; cassava; pineapples; cotton; *Indigofera endecaphylla*; Cosmos and Zinnia seedlings; tobacco was rarely touched. Sesamum appeared to be totally imune and sweet potatoes nearly so.

In a large number of cases feeding on trees was confined to biting through the leaf stalk rather than the devouring of the lamina. Complete defoliation of some trees was thus brought about, the ground below being carpeted with the green leaves. In the case of fruit trees the bark was frequently devoured as well as leaves and buds, and the blossom of mango and avocado pears was rapidly destroyed. It sometimes occurred that in the case of neighbouring trees of the same species, *Eucalyptus rostrata* for example, one would be stripped bare of foliage in a night and the other remain practically untouched, although both were equally heavily covered with locusts. The following trees were completely defoliated: *Ziziphus* sp. (vern. *masau*); *Cordyla africana* (vern. *ntondo*); *Albizzia Lebbek*; *Poinsettia*; *Cupressus lusitanica*; *Casuarina* spp., but adjacent *Cassia* only slightly attacked; *Eucalyptus rostrata*; *Cedrela toona*; bamboo; tung oil; *Acacia arabica*; *Acacia campylacantha* (vern. *mtete.*); *Sclerocarya caffra* (vern. *ntondowoko*); mango blossom; fruit trees, buds, blossom, leaves and bark; *Ficus*? *dekdekana* (vern. *kachere*).

The following appeared to be immune: *Eucalyptus citriodora*; *Uapaca kirkiana* (vern. *masuku*); mulberry.

The breaking off of large branches of trees owing to the weight of the locusts resting on them occurred quite frequently. The trees particularly observed were *Khaya senegalensis* (vern. *mbawa*). In one case four branches, approximately 12 feet long each and with a basal circumference varying from 7½ to 10 inches, were examined and appeared to be perfectly healthy. Two larger branches with basal circumferences of 20 and 30 inches were slightly diseased. Although this tree is probably much above the average as regards brittleness, at the time the breaking occurred 160 locusts weighed only just over 11 ounces.

The association of birds with flying swarms of *Nomadacris* was noted on several occasions but only rarely were they seen in such numbers as to excite comment. Hawks of various kinds were most commonly reported, while crows, storks, hornbills, drongos and wattled starlings were also observed to be feeding on them to some degree. The gut of a stray spoonbill, shot at Mlanje, was crammed with locusts, though the nearest swarms at the time were some 20 miles away, and it was thought that the bird in question was not of the local species but belonged to the Zambezi valley type.

Native Names, etc. for Locusts.—Most tribes appear to have distinctive names for grasshoppers, and locusts, and usually for the two species of locust, *Nomadacris* and *Locusta*, known in the Protectorate. The word *nazombe*, or *dzombe*, used by nearly all tribes, refers to swarms of locusts in general as opposed to the individual insects and to grasshoppers in general which are called *zitete* (pl.). The Achewa (Lilongwe district) also used the word *kambuna* (lit: a little game pit) when referring to locusts laying eggs, but this term was not heard elsewhere.

Tribe	Hoppers	*L. migratorioides*	*N. septemfasciata*	1909 variety.
Amang'anja, Angoni, Achewa	Namseta or Mandowa	Cilimanine or Cilimanile	Cimbalanga	Magagada
Amang'anja, Sena (Lower Shire)	...	Kadontolo	Nyadzombe	...
Arabiah (North Nyasa)	Cipume	Cipume	...	Gwalanje
Alomwe (P. E. A. and Lake Shilwa)	Mantintini	Macolokwi	...	Nasombe
Anguru	Uzombe	Uzombe	...	Uzombe

Some confusion is caused by the use of a special name which is s'ated to refer to a large type of locust that invaded the country in 1909. In some cases recollection of locusts in that year seems to be reasonably clear, but it is insisted upon that these locusts (at any rate where the name *magagada* is given to them), though similar to *Nomadacris*, were much larger and darker in colour and were certainly distinct from the large solitary *Acridiidae*. As there are no records of locusts other than the two species mentioned ever having occurred in the Protectorate, it is probable that *Nomadacris* is really the locust in question but that some variation in size or colouring of the 1909 swarms has led to the belief that it was another kind.

In view of the fact that, generally, natives appear to realise that locusts lay eggs which hatch into hoppers, it seems extraordinary that there should be such a strong popular belief that the first flying individuals found in a swarm "have come to teach the hoppers how to fly". Less strange is the firm conviction that the auditory organs are the eyes.

Natives insist that lions devour the hoppers and, though this was never satisfactorily proved' lion spoor was certainly found in hopper swarms. As dogs, particularly native dogs, readily feed on hoppers, it seems possible that the larger carnivora may do so too. The lake shore natives in the vicinity of Domira Bay collected large numbers of hoppers and stored them in specially made baskets of lightly woven leaves, weighing up to 10 lbs. or more, dozens of such baskets being hung up outside the huts.

The Fungus Disease (*Empusa grylli*).—The disease was first noticed in a small swarm of 2nd instar hoppers in the Bwanje valley on February 12, 1934. From then onwards its presence was reported in every area of the Northern Province, and later it developed throughout almost the whole of the Protectorate, with the possible exception of the Lower Shire district. It was particularly effective in the Northern Province during February and March owing to the weather conditions being very suitable for its development and spread. A few empirical attempts were made to distribute the disease, but it was almost impossible to find a swarm in which the fungus was not present to some degree. Later, when the disease was studied more closely with the assistance of the Mycologist, it was realised that these attempts had been quite useless as the material used, dead hoppers on grass stalks collected during the day, carried practically no fungus spores.

In the field the disease appeared to attack hoppers in all stages after the first instar and to some extent the adults as well, though in general by the time the adults have developed the local climatic conditions are no longer suitable for the further growth of the fungus. There is no doubt that the disease was responsible for reducing the size of the hopper swarms to a very considerable extent during the 1933-34 period.

Conclusion.—The popular local belief that " locusts and drought years go together " might, at a superficial glance, appear to have some substratum of fact to support it, but it will not stand too close investigation. The rainfall in the 1932-33 season was certainly below normal over most of the Protectorate, when the *Nomadacris* locusts arrived. In the Lower Shire and Chikwawa districts, where the total precipitation was some 5 inches below normal, rainfall was extremely localised in January and February; there was a general shortage in March and an absence of mid-season rains. Generally, the short rainfall was also accompanied by low temperatures and lack of sunshine. But the 1933-34 season was by no means similar, and, though in some places the concentration of rain in February or March was slightly above the average, on the whole the season was characterised by continuous rather than excessive wet weather.

It would seem that the greater portion of the Protectorate is suitable, climatically and vegetatively, for the temporary breeding of both *Locusta* and *Nomadacris* locusts. In the case of the former species, however, by the time the locusts have reached Nyasaland the swarming cycle is definitely on the wane and the country is apparently situated at about the extreme limit of the migration. With *Nomadacris*, however, as the permanent breeding grounds are probably situated in north-eastern Rhodesia, the Protectorate is open to more concentrated invasions.

It appears, however, from a study of the average precipitation during January and February, or February and March, that natural control by the fungus disease might be expected to occur in most years in certain districts. It would be more likely to occur in the January-February period than later, and thus the earlier the swarms tend to breed the greater is the chance that the disease will develop during the hopper period. The Lower Shire and Chikwawa districts would seem unlikely to be assisted by the disease at all, and the lake-shore areas of the South Nyasa, Dedza and Dowa districts, the Upper Shire, Ncheu, Lilongwe and Kasungu districts would be unlikely to benefit unless hopper development began in January.

ACKNOWLEDGEMENTS.

Thanks are due to a number of gentlemen who have assisted most liberally with information concerning locust movements, climatic records and other observations which would not otherwise have been obtained. Apart from those officers of the administration, the Agricultural Department, the Geological Survey, the Empire Cotton Growing Corporation, the Native Tobacco Board and the temporary locust officers who have kept me supplied with valuable data, I wish to record my particular indebtedness in these matters to Messrs. Boby and Stevens in the Lower River districts, to Mr. Gamlen of the northern extension of the railway, to Messrs. Watling, Down, Twynam, Warren and Cole in the Lilongwe area, to Mr. Dent in the Bwanje valley, and Mr. Gibson at Mlanje. I feel assured that similar assistance will be forthcoming in the future should it, unfortunately, be required.

Notes on Crop Pests.

Tobacco.—A small black shield bug (*Cydnus* sp.) was recorded as doing some damage in a nursery in Cholo, but was not observed personally. Some years ago (1923) *Cydnus lepidus*, Dist. was observed in large numbers at the roots of tobacco plants in the field, but was not associated on that occasion with any particular damage.

Small grasshoppers, species of *Acrydium*, were recorded at the same time and place to be destroying the leaves of very young seedlings.

Grasshoppers, in general, were reported from many sources to be unusually abundant this year, but whether this was really so or whether the advent of locusts had prompted a keener observation on the grasshopper population it is impossible to say.

Yellow stem-grub (*Dereodus recticollis*, Mshl.) again gave trouble in some nurseries.

Whitefly (*Aleurodidae*)—During February, a small patch of native-grown tobacco between the Likasa and Bua rivers, apparently completely isolated by some considerable distance from any other gardens, was found to be infected to the extent of nearly 100 per cent with leaf curl, indicating that both the insect and the disease are very widely distributed. On several other occasions in the Northern Province, old tobacco plants carrying both the disease and the immature forms of the whitefly were found in close proximity to newly planted gardens.

Coffee.—A single specimen of the larva of the white stemborer (*Anthores leuconotus*, Pasc.) was found in a tea plant in the Cholo district. Although tea and coffee have been grown fairly close together for some years now in this district, this is the only record of this beetle attacking tea.

A wild shrub, believed to be a host plant of this pest, was found by the Mycologist at Mlanje. Specimens have not yet reached the adult stage, but from their general appearance and the formation of the tunnels and the frass there is little doubt that they are *Anthores* grubs. Owing to pressure of other work identification of the shrub has not yet been made and some confusion has arisen as to the vernacular name or names for it. It does not appear to be any one of the three Rubiaceous plants discovered in Tanganyika to be hosts of this insect (*R. A. E. XXI. A. p.364*).

Citrus.—In view of the investigations at present in progress with regard to establishing a citrus industry in the Protectorate, it may be as well again to draw the attention of those interested in the cultivation of fruit trees to the statement made under this heading in the last report. The control of the insect pests of citrus or other fruit trees will require as much annual attention as any other process in their cultivation. In South Africa, where fumigating or spraying materials are manufactured in the country, the all-in cost of fumigating against scale insects, for example, can be maintained at about 1/- per tree per annum, It may be a very different problem in Nyasaland. The elegant grasshopper (*Zonocerus elegans*, Thunb.) was exceptionally serious on citrus, as well as many other plants, in the Lower Shire district in the early part of the year.

Identifications.

Larvae of *Mometa zemioides*, Durrant, from cotton in Angola were identified for the Manager of the Compagnie Cotonniere du Mozambique; larvae of *Lyctidae* and *Bostrychidae*, boring in timber and planks, were identified for Dr. C. W. B. Arnold of The Imperial Tobacco Company; collections of various insects were identified for District Agricultural Officers and others.

Colin Smee,
Entomologist.

Report of the Mycologist.

General.

Clearing and opening up of the land chosen for the Mlanje Experimental Station commenced in June. Thirty acres was cleared, contour bunded and ready for planting with tea by the end of the year.

The effect of the sulphate treatment for tea yellows disease has shown up very satisfactorily throughout the tea areas of Mlanje and Cholo. At the present rate of improvement the disease should be of negligible importance by the end of 1934 if the treatment is not allowed to lapse.

Diseases of tea in Nyasaland are, on the whole, conspicuous by their absence; the only one that is likely to cause any extensive trouble is *Armillaria* root disease. This continues to be a nuisance on some estates. Further observations have been made on this disease.

Preliminary experiments with the storage of tea seed were carried out. Satisfactory results were obtained which will be tested out on a large scale in the laboratory and on estates in 1934.

Tea.

Armillaria Root Disease.—This disease of a multitude of economic trees and shrubs usually spreads through the soil in temperate countries by means of boot-lace-like structures known as *rhizomorphs.* These are "rare under African conditions" and it has been thought that the fungus spreads in Nyasaland more by contact of healthy with diseased roots than by means of rhizomorphs growing from a diseased to a healthy plant through the soil. Rhizomorphs have been found, however, growing plentifully from the dead roots of *nandolo* (*Cajanus indicus*) killed by *Armillaria* in a patch of badly affected tea in Mlanje and to a lesser extent on dead tea plants in Cholo. Whether these rhizomorphs are of any material influence on the spread of the disease in Nyasaland is difficult to say. They have not been found growing so extensively as in temperate countries. Rhizomorphs are claimed elsewhere to continue their typical growth through the soil, even after being severed by cultivation of the soil; each piece of rhizomorph is then considered to be a potential source of infecton. It has been stated before (Annual Report for 1931) that trenching as a control measure for the disease in young gardens cannot be recommended except where the disease occurs in localised areas. It is evident from experience that perseverance with the continual removal of dead tea plants and any affected indigenous tree roots found amongst them will gradually wipe out the disease. This and observations in 1933 point to the conclusion that the spread of the disease in Nyasaland is primarily associated with the presence of *Armillaria* in the dead roots of the cleared forest trees. The mere removal of diseased roots would not effect a control for the disease if isolated unattached rhizomorphs were capable of continuing infection of the replanted tea.

Some data were collected with the object of assisting planters to know which of the indigenous forest trees are most likely to pass the disease on to tea. Thanks are due to the help and co-operation of several planters in Mlanje and Cholo for the data obtained. Some of the few trees listed below are already known to the older Nyasaland planters as sources of infection for this disease: they are repeated here in case they may be of assistance to those starting to plant tea in this country. Undoubtedly the worst tree is *muula*, not only because its roots often become infected but also because it has a very wide-spreading lateral root system together with a deep tap root. The following is a list of the worst offenders:

in Mlanje

Muula	(*Parinarium mobola* Oliv.)
Mwanga	(*Afrormosia angolensis* Bak.)
Mlombwa	(*Pterocarpus angolensis* DC.)
Kamponi	(*Isoberlinia globifera* (Benth.) Hutch.)
Mkalati	(*Burkea africana* Hook.)

in Cholo

Muula	(*Parinarium mobola* Oliv.)
Tsamba	(*Brachystegia bragaei* Harms.)

While the work on the opening up of the Mlanje Experimental Station was in progress it was noticed that *Armillaria* was very seldom found on the roots of living trees. On the other hand, many dead stumps of *muula* and *kamponi* were found to be infected. This indicates that *old stumps found during clearing should be given special attention* by planters. Tree stumps are commonly found in virgin forest and have probably been left as such for the following reasons: (i) old native gardens cleared during "shifting cultivation" in the past, (ii) haphazard cutting of firewood on private estates, (iii) pilfering of trees for domestic purposes by natives.

A gang of natives could easily be trained to recognise dead stumps affected with *Armillaria* and could pay special attention to the more thorough removal of these stumps and their roots. Although planters know the symptoms of the disease in tea they are inclined to mistake the fungus in dead roots of indigenous forest trees for that of a species of *Psilocybe* which causes a rot not unlike that caused by *Armillaria.* The essential differences between the two are that (a) *Armillaria* rot is wet while *Psilocybe* rot is dry, (b) *Armillaria* usually forms black fungoid outgrowths running longitudinally in cracks along the outer surface of the roots. *Psilocybe* is not parasitic and need cause no worry. Incidentally, it is found commonly causing a dry rot of dead *msuku* stumps and is often mistaken for *Armillaria* which is seldom found on these stumps.

Seed Storage.—The Indian jat seed ripens in Nyasaland from April to July so that, unless the seed can be stored, it cannot be used for planting at stake on account of the long dry season from May to December. Attempts made by planters in the past to store seed in sealed tins have not met with success although this is stated to be a satisfactory method in India (Harrison, C. J., Indian Tea Assoc. Quart. Journal 1926).

Experiments were carried out to find out if there is a method of storing tea seed which can be used with confidence and reliability on a commercial scale. The experiments were of an entirely preliminary nature as they were started late in the season. From the results obtained successful storage would seem to depend on the moisture content of the seed when stored in sealed tins. These results are to be followed up in more detail in 1934 and an attempt is to be made to store some seed on a commercial scale.

The results showed that seed was stored successfully only when it had been dried out to an approximate loss of 5 per cent. of its original moisture content. The seed was taken straight out of the capsules, tested for "floaters" and only "sinkers" were used for storage. The seed was dried to the following percentage losses of moisture: 0,5,10,15,20,25,30. It was then stored in sealed tins with and without charcoal. Tests for germination after six months' storage gave the following results approximately for three different experiments:

Percentage loss of moisture	...	...	0	5	10	15	20	25	30
Percentage germination	...	...	5	90	5	0	0	0	0

It remains to be seen whether the seedlings grown from the stored seed have the same vitality as those grown from fresh seed. Some seed has been kept ten months for this purpose and is to be compared with fresh seed in April 1934. Other seed is being stored to find out how long it is possible to store seed successfully under these optimum conditions.

Mlanje Experimental Station.

The site for the station was chosen on a block of Government land which for some miraculous reason had avoided the ravages of native cultivation and had thus retained its virgin forest. The soil is a deep red loam typical of a large area under tea cultivation in Nyasaland. The lie of the land which has a gentle slope on the higher land and falls steeply down to the Nswadzi stream has proved very satisfactory as it has been possible to arrange the various yield experiments on the flatter land while the steeper slopes have been divided up into demonstration plots. Mr. M. P. Barrow, Namingomba Estate, Cholo, very kindly lent the station two of his stumping jacks for clearing the land and many thanks are due for this assistance.

The experimental plots have been laid out to obtain accurate data (by comparison of yields) on the following problems which were considered to be of primary interest to the tea industry by the advisory committee of the Nyasaland Tea Research Association and the Department of Agriculture.

1. Fertilizers.
2. Methods of forming the permanent framework of tea bushes.
3. Green manures with and without artificial fertilizers.
4. Effect of applying fertilizers at different times of the year.
5. Methods of plucking.
6. Planting distances.
7. Methods of pruning.

The demonstration plots have been designed to include the following:

1. Methods of contour bunding and terracing.
2. Various species of plants for strengthening contour bunds and terraces (known species and selected weeds).
3. Various ground cover crops (including selected weeds).
4. Green manure crops (including selected weeds).
5. Species of high and low shade plants.

Ruo Estates Ltd. have kindly put 30 acres of old local jat tea at the disposal of the station for experimental purposes. This tea is representative of a large acreage of tea in Nyasaland. The Experimental Station is being planted with local Indian jat plants. The following experiments have been started at Ruo and uniformity trials are being started in March:

1. Methods of pruning throughout one pruning cycle.
2. Methods of plucking.
3. Fertilizers.

There is also a demonstration block of high shade (local *Albizzia* (*chikwani*)), low shade (*Glyricidia maculata)* and no shade.

Mango.

Fruit Spot and Canker.—A disease of mango fruits and stems which at first sight seemed to be of fungous or bacterial origin is thought to be due to the feeding of a sucking insect. The activities of the insect seem to be confined to the fruiting season. A more detailed examination of the disease is to be carried out in 1934.

R. Leach,
Mycologist.

EUROPEAN AGRICULTURE.

Name of district.	Total acreage under cultivation. acres.	Tobacco. Total. Acres under crop.	Tobacco. Total. Yield cwt.	Tobacco. *Fire-cured.* Acres under crop.	Tobacco. *Fire-cured.* Yield cwt.	Tobacco. *Flue-cured.* Acres under crop	Tobacco. *Flue-cured.* Yield cwt.	Tobacco. *Air-cured.* Acres under crop.	Tobacco. *Air-cured.* Yield cwt.	Tea. Acres under crop.	Tea. Yield cwt.	Coffee. Acres under crop.	Coffee. Yield cwt.
Lower Shire ...	51	...	...	...	...	...	...	...	...	..	..	...	...
Chikwawa ...	188	135	518	...	...	*135*	*518*	...	...	..	..	...	...
Central Shire ...	248	130	463	...	.	*130*	*463*	...	...	...	...	...	...
Cholo ...	13,990	1,855	6,576	*225*	*639*	*1,545*	*5,697*	*85*	*240*	5,390	1,458	404	208
Mlanje ...	11,093	415	2,733	*79*	*351*	*258*	*1,941*	*78*	*441*	8,440	25,772	197	278
Blantyre ...	5,305	1,070	4,924	*279*	*1,308*	*726*	*3,365*	*65*	*251*	...	...	296	350
Chiradzulu ...	2,673	295	849	*15*	*40*	*280*	*809*	...	..	..	..	..	..
Zomba ...	3,373	872	3,103	*8*	*35*	*859*	*3,049*	*5*	*19*	...	...	44	41
Upper Shire ...	148	72	365	*72*	*365*	...	...	...	...	...	...	...	...
South Nyasa ...	1,409	1,033	3,573	*30*	*80*	*991*	*3,453*	*12*	*60*	..	..	2	..
Ncheu ...	1,636	1,105	4,357	*679*	*2,937*	*63*	*184*	*363*	*1,236*	..	...	95	153
Dedza ...	659	185	698	*16*	*60*	*169*	*638*	...	...	..	...	16	22
Fort Manning ...	182	126	540	*39*	*195*	*39*	*166*	*48*	*179*	.	...	1	1
Lilongwe ...	1,797	487	2,048	*140*	*393*	*49*	*252*	*298*	*1,403*	..	...	...	..
Dowa ...	861	70	336	...	..	...	...	*70*	*336*	...		...	...
Kota Kota ...	63	...	...	...	..		..	..	..	..	..	1	1
Kasungu ...	28	...	.			.	..	.	..	.	.	..	..
Mombera ...	163	...						...		.		124	59
West Nyasa ...	1,515	...	...	...	..	...		..	..	..	...	...	.
North Nyasa ...	117	12	60	...	..	*12*	*60*	.	..	.	...	30	15
Total ...	45,499	7,862	31,143	*1,582*	*6,403*	*5,256*	*20,575*	*1,024*	*4,165*	13,830	27,230	1,210	1,128

NOTE:—TEA: Acreage in plucking 1933 was 8,261. COFFEE: Acreage in bearing 1933 was 618.

EUROPEAN AGRICULTURE—CONTINUED.

Name of district	Sisal. Acres under crop.	Sisal. Yield cwt.	Cotton. Acres under crop.	Cotton. Yield cwt. (lint)	Rubber. Acres under crop.	Rubber. Yield cwt.	Chillies and Capsicums. Acres under crop.	Chillies and Capsicums. Yield cwt.	Maize. Acres under crop.	Maize. Yield cwt.	Wheat. Acres under crop.	Wheat. Yield cwt.
Lower Shire	...	...	19	17	...	.	3	5	..	...	...	..
Chikwawa	...	...	8	80	...	...	...	...	25	290	.	..
Central Shire	...	...	..	...	...	...	...	...	7	56	...	...
Cholo	...	..	45	200	...	...	...	..	236	2,904	25	118
Mlanje	...		...	...	...	...	7	31	268	3,660	2	13
Blantyre	..	...	60	142	...	...	8	20	368	3,861	6	7
Chiradzulu	..	...	...	...	...	...	...	...	24	420	...	...
Zomba	...	...	10	22	...	...	...	...	326	12,023	...	...
Upper Shire	...	...	...	...	...	...	...	...	18	65	...	...
South Nyasa	...	...	...	...	...	...	...	...	...	...	...	...
Ncheu	...	...	45	90	...	...	...	...	125	1,624	..	...
Dedza	...	...	...	.	...	..	5	1	115	1,775	27	97
Fort Manning	...	...	...	...	...	...	...	...	15	440	15	11
Lilongwe	...	...	...	..	...	...	...	...	382	6,012	...	...
Dowa	...	...	59	131	...	...	...	...	30	750	...	..
Kota Kota	.	...	...	...	...	...	...	...	15	100	6	20
Kasungu	...	...	...	..	...	...	...	...	15	62	...	.
Mombera	..	...	...	...	...	...	...	...	5	82	1	11
West Nyasa	...	...	..	...	1,500	...	...	...	...	...	...	..
North Nyasa	...		...	...	...	...	...	...	43	207	...	..
Total ...	...	...	246	682	1,500	...	23	57	2,017	34,331	82	277

EUROPEAN AGRICULTURE—CONTINUED.

Name of district.	Legumes.							Oil Seeds.					
	Total.		*For food.*		*For fodder*		*For green ma'ng.*	Total.		*For crushing.*		*For food.*	
	Acres under crop.	Yield cwt.	*Acres under crop.*	*Yield cwt.*	*Acres under crop.*	*Yield cwt.*	*Acres under crop.*	Acres under crop.	Yield cwt.	*Acres under crop.*	*Yield cwt.*	*Acres under crop.*	*Yield cwt.*
Lower Shire	8	71	*8*	*71*	...	...	...	14	79	*10*	*40*	*4*	*39*
Chikwawa	...	...	...	...	...	...	...	...	...	...	...	...	...
Central Shire	44	11	*4*	*11*	...	...	*40*	...	...	...	...	...	...
Cholo	1,303	1,365	*20*	*1,265*	*5*	*100*	*1,278*	6	8	...	...	*6*	*8*
Mlanje	562	232	*122*	*232*	...	...	*440*	...	...	...	...	...	...
Blantyre	449	2,806	*109*	*904*	*122*	*1,902*	*218*	1	5	...	...	*1*	*5*
Chiradzulu	203	322	*18*	*22*	*15*	*300*	*170*	...	...	...	...	...	...
Zomba	298	2,193	*206*	*1,443*	*43*	*750*	*49*	26	142	...	...	*26*	*142*
Upper Shire	32	2	*1*	*2*	...	...	*31*	1	1	...	...	*1*	*1*
South Nyasa	38	...	...	...	...	...	*38*	...	...	...	...	..	...
Ncheu	120	135	*23*	*135*	...	...	*97*	15	190	*5*	*30*	*10*	*160*
Dedza	113	251	*16*	*241*	*2*	*10*	*95*	3	20	...	...	*3*	*20*
Fort Manning	2	...	...	...	...	...	*2*	...	...	...	...	...	...
Lilongwe	217	53	*16*	*53*	...	...	*201*	20	200	...	...	*20*	*200*
Dowa	229	...	...	...	...	...	*229*	10	90	...	...	*10*	*90*
Kota Kota	...	...	...	...	...	...	...	...	...	...	...	...	...
Kasungu	2	45	*2*	*45*	...	...	...	...	...	...	...	...	...
Mombera	...	...	...	...	...	...	...	...	...	...	...	...	...
West Nyasa	5	60	*5*	*60*	...	...	...	3	20	...	...	*3*	*20*
North Nyasa	5	22	*5*	*22*	...	...	...	2	16	*2*	*16*	...	...
Total ...	3,630	7,568	*555*	*4,506*	*187*	*3,062*	*2,888*	101	771	*17*	*86*	*84*	*685*

EUROPEAN AGRICULTURE—CONTINUED.

Name of district.	Tung Oil.		Fruit Trees.		Nut-Bearing Trees.		Miscellaneous.		Woodland Artificialy Established.
	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres.
Lower Shire	...	...	1	11	...	...	...	...	6
Chikwawa	...	...	...	...	...	...	5	...	15
Central Shire	...	...	1	...	...	...	...	...	66
Cholo	18	...	118	2	45	...	6	25	4,539
Mlanje	15	...	1	...	...	...	...	...	1,186
Blantyre	2	...	12	...	...	...	...	...	3,033
Chiradzulu	10	...	6	...	...	...	...	...	2,141
Zomba	7	...	...	...	...	...	42	211	1,742
Upper Shire	6	...	3	...	...	...	...	...	16
South Nyasa	5	...	...	...	...	...	...	...	329
Ncheu	...	...	7	10	...	...	...	...	116
Dedza	...	...	32	130	9	...	...	...	154
Fort Manning	...	...	2	4	...	...	...	...	21
Lilongwe	2	...	2	35	...	...	...	...	687
Dowa	...	...	5	3	...	...	...	...	458
Kota Kota	...	...	1	1	...	...	...	...	40
Kasungu	...	...	1	...	...	...	...	...	10
Mombera	..	...	...	...	...	...	...	...	33
West Nyasa	...	...	2	...	...	...	...	...	5
North Nyasa	...	...	...	...	...	...	...	...	25
Total ...	65	...	194	196	54	...	53	236	14,622

NATIVE AGRICULTURE, 1933.

District.	Seed Cotton	Rice	Wheat	Ground-nuts	Tobacco	Maize	Peas and Beans
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Lower Shire ...	2,013						
Chikwawa ...	821						
Central Shire ...	146						
Cholo ...					12		
Mlanje ...					392		
Blantyre ...	14				248		
Chiradzulu ...					394		
Zomba ...					254		
Upper Shire ...	4				15		
South Nyasa ...							
Ncheu ...	77				131		
Dedza ...	5				215		
Fort Manning ...					105		
Lilongwe ...					1,421		
Dowa ...					843		
Kota Kota ...					47		
Kasungu ...							
Mombera ...							
West Nyasa ...							
North Nyasa ...							
Total	3,080				4,077		

NOTE.—Maize is the staple foodstuff in most districts; groundnuts, rice, wheat, beans and various other crops are also grown by natives for local consumption, but it is impossible to make an accurate estimate of the quantities of any of these crops.

The above tobacco and cotton figures represent the quantities purchased in each district, and do not accurately reflect the production by districts, as many natives grow their tobacco and cotton in one district and sell in another.

NATIVE LIVE STOCK AT 31ST DECEMBER, 1933.

District.	Cattle.	Sheep.	Goats.	Pigs.
Lower Shire	135	1,810	9,357	3,293
Chikwawa	172	1,141	7,643	1,512
Central Shire	551	707	3,715	3,641
Cholo	109	743	4,039	4,791
Mlanje	390	2,630	9,309	5,876
Blantyre	1,214	1,131	6,163	5,978
Chiradzulu	1,016	893	6,218	2,663
Zomba	903	677	1,304	181
Upper Shire	72	3,078	7,339	559
South Nyasa	655	7,010	9,744	133
Ncheu	14,800	4,500	27,500	6,500
Dedza	20,375	17,088	29,767	10,423
Fort Manning	1,253	3,350	8,500	3,900
Lilongwe	39,520	6,912	50,279	3,643
Dowa	15,355	15,860	27,260	13,089
Kota Kota	2,730	2,948	10,397	2,183
Kasungu	2,042	2,945	1,977	4
Mombera	41,445	8,802	18,370	13
West Nyasa	1,937	384	523	—
North Nyasa	33,894	323	1,788	—
Total	178,568	82,932	241,192	68,382

LIVE STOCK OWNED BY EUROPEANS AT 31ST DECEMBER, 1933.

District.	Cows and heifers.	Bulls.	Oxen.	Calves.	Pedigree cattle.	Horses.	Mules.	Donkeys.	Sheep.	Goats.	Pigs
Lower Shire	1,034	20	502	602	2	...	...	...	267	143	98
Chikwawa	225	7	103	120	...	...	...	17	...	...	...
Central Shire	40	2	25	6	1	...	...	1	...	...	...
Cholo	1,644	49	1,125	764	11	...	...	31	321	14	160
Mlanje	1,046	27	845	415	3	...	...	5	413	37	141
Blantyre	1,357	29	1,070	608	30	4	...	11	41	11	201
Chiradzulu	710	11	401	303	14	...	...	6	46	...	89
Zomba	1,364	33	1,043	421	18	1	...	28	364	...	68
Upper Shire	10	1	4	5	...	...	...	...	24	95	26
South Nyasa	30	5	26	16	...	...	...	...	51	160	...
Ncheu	326	9	182	91	5	...	...	6	75	40	103
Dedza	393	29	688	326	10	...	...	61	337	...	135
Fort Manning	77	2	84	14	...	...	...	...	25	...	18
Lilongwe	227	12	237	101	...	...	...	15	66	57	133
Dowa	16	...	12	2	...	...	...	2	70	9	5
Kota Kota	19	3	30	8	...	...	...	5	57	...	
Kasungu	...	...	...	...	...	...	...	...	7	...	10
Mombera	20	2	21	8	...	...	...	7	25	7	45
West Nyasa	15	6	8	4	...	...	...	...	...	...	26
North Nyasa	159	7	159	75	...	...	...		104		36
Total ...	8,712	254	6,565	3,889	94	5	...	195	2,293	573	1,300

Annexure I.

An Analysis of the Cost of the Native Tobacco Board 1933.

RECEIPTS			PAYMENTS		
Balance brought forward from 1932		£13,342 1 0	*Personal Emoluments*		
Revenue 1933			*European Staff*		
Tobacco Tax	£8,111 5 0		Secretary ... £50 0 0		
Sale of tobacco seed to Natives	2,335 13 3		Agent 438 4 6		
Sale of tobacco seed to Europeans ...	39 11 3		Area Supervisors, 2 @ £600 1,200 0 0		
Sale of tobacco leaf ...	56 14 5		Supervisors, 4 @ £500 2,011 13 4		
Sale of miscellaneous seeds	8 3 10		Supervisors 6 @ £360 by £18 to £450 2,315 0 2		
Miscellaneous receipts ...	1 0 0		Supervisors, temporary, 1 for 2 months @ £300 and 1 for 5 months @ £400 ... 213 8 10		
Sale of tobacco booklets	37 7 5		Agent temporary 3½ months @ £30 per month 107 0 0		
Interest on fixed deposit	245 10 0		Acting allowance ... 20 11 3	£6,355 18 1	
Total Revenue ...		10,835 5 2	*Native Staff*		
Advances Returned		323 12 9	21 Clerks, rates and periods variable, £3 to £18 93 1 9		
			219 Capitaos, rates and periods variable, £6 12s. to £21 1,907 16 3		
			11 Watchmen @ 11s. per month 43 4 1		
			1 Messenger @ 8s. 4d. per month 0 8 0	2,044 10 1	
			Total Personal Emoluments		£8,400 8 0
			Other Charges		
			Travelling	1,139 1 11	
			Passages	375 14 8	
			Seed and Experimental Plots	220 18 2	
			Stationery and Printing ...	109 14 11	
			Implements and Equipment	11 12 0	
			Typewriter	22 1 2	
			Incidentals	36 16 11	
			Fertilizers for Natives ...	18 6 0	
			Uniforms	80 9 9	
			Tents	13 4 6	
			Pedal Cycles	37 10 0	
			Allowance to Supervisors towards cost of Housing	60 0 0	
			Total Other Charges ...		2,125 10 0
			Contributions		
			Roads	40 8 4	
			Zomba Experimental Station	300 0 0	
			Nyasaland Government— Clerical Assistance ...	216 0 0	
			Total Contributions ...		556 8 4
			Central Buying Stations		
			Permanent station hands	17 18 0	
			Erection and enlargement of	82 6 0	
			Total Central Buying Stations		100 4 0
			Special Expenditure		
			House for Senior Supervisor	214 17 2	
			Furniture for new house Lilongwe	25 13 4	
			Total Special Expenditure		240 10 6
			Advances made		225 11 2
			Balance at Treasury ...	164 11 10	
			,, ,, Bank ...	3,687 14 11	
			,, ,, ,, on Deposit	9,000 0 0	
			Total Balance carried forward to 1934		12,852 6 9
		£24,500 18 11			24,500 18 11